UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

September 8, 2000

WMD-SSMB

MEMORANDUM

Subject: Five-Year Review Report
Petroleum Products Corporation Superfund Site
Town of Pembroke Park, Broward County, Florida

From: Kevin S. Misenheimer, RPM
South Site Management Branch

Thru: Curt Fehn, Branch Chief
South Site Management Branch

To: Richard D. Green, Director
Waste Management Division

Attached is a copy of the Five-Year Review Report for the Petroleum Products Corporation NPL Site, located in Broward County, Florida. Your signature is requested on the signature page of the report, to formally document the completion of the five-year review.

Petroleum Products Corporation operated as a re-refiner of waste oil from approximately 1958 until 1971. Then the company began operating as a storage facility. Investigations have indicated contamination in soils underlying the site from a variety of organic and inorganic compounds. A free-floating oil layer was identified in the southeastern portion of the site. The interim record of decision (ROD) and subsequent explanation of significant differences (ESD) for operable unit one, addressed recovery of free product and control of migration of dissolved phase contaminants in the ground water. A bioslurper waste oil recovery system is currently operating at the site. A second operable unit will address the contaminated subsurface soil and re-refinery acid and clay sludges.

The Five-Year Review Report concluded that the selected remedy is expected to remain protective of human health and the environment. However, the report identified several issues that should be addressed to ensure that the remedy remains protective. Among these include further sampling of an adjacent trailer park to determine the extent of soil contamination that possibly migrated from the site. Also, concerns were raised about sediment contamination in a nearby lake. Both of these concerns are being addressed by either EPA or the State of Florida. Additionally, the report noted that historically, the water quality re-injection standards had been exceeded during operation of the waste oil recovery system. To correct this problem, modifictions are being made to the system, including the addition of a chemical treatment system

for the effluent water.

A subsequent five-year review will be requires to continue evaluation of the protectiveness of the selected remedy. It is anticipated that this review will be completed in 2005. Please contact me at extension 2-8922 if you have any questions.

Attachment

KSM 9/8/00

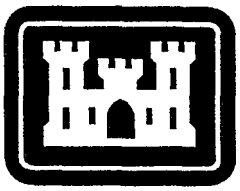
MISENHEIMER

MCGUIRE

FEHN

GREEN

9/8/00



US Army Corps of Engineers
Jacksonville District

Superfund Five-Year Review Report

Petroleum Products Corporation Town of Pembroke Park, Broward County, Florida

Prepared for
U.S. Environmental Protection Agency, Region IV
August 2000

EPA Five-Year Review Signature Cover

Preliminary Information

Site name: Petroleum Products Corporation			EPA ID: **FLD980798698**
Region: **04**	State: **Florida**	City/County: **Broward County**	
LTRA* (highlight): **Y N**		Construction completion date: **August 1995**	
Fund/PRP Lead: **PRP**			NLP status: **Final**
Lead agency: **EPA, Region 4**			
Who conducted the review (EPA region, state, Federal agencies or contractor): **US Army Corps of Engineers, Jacksonville District**			
Dates review conducted: From: **2/01/00** To: **5/25/00**			Date(s) of Site visit: **03/21/00**
Whether first or successive review: **First Review**			
Circle: Statutory **Policy**		Due date: **8/30/00**	
Trigger for this review (name and date): **Initiation of Remedial Action, 8/30/95**			
Recycling, reuse, redevelopment site (highlight): **Y N**			

Deficiencies:

Some deficiencies were identified. See Section VII: Deficiencies.

Recommendations:

Recommendations addressing the deficiencies and additional recommendations are provided in Section VIII: Recommendations.

Protectiveness Statement(s):

The selected remedy is expected to be protective of human health and the environment although there are potential exposure concerns at the trailer park to the south of Petroleum Products Corporation and the warehouse bays overlying areas of waste oil.

The selected remedy, as executed, provides an innovative approach to recovering used oil. Reinjected water has periodically exceeded the FDEP limit of 5 ppm Total Petroleum Hydrocarbons. The water treatment system is being modified to address this issue and has been out of operation since November 1999. The bioslurping and water treatment system should recommence operation late-summer 2000.

Recent soil sampling data collected at the trailer park to the south of Petroleum Products Corporation, across Carolina Street, noted contaminant levels above the FDEP's Soil Cleanup Target Levels (SCTLs). Recent sediment sampling at the trailer park lake across Carolina Street noted high concentrations of semivolatile organic Tentatively Identified Compounds. There is a possibility that direct exposure to the former sludge pits or waste oil may occur due to cracks in slab, dissolving of the asphalt by the waste oil, or other pathways of exposure yet unrecognized.

Additional assessment should be performed at the trailer park located south of the Site and any warehouse bays overlying the two former sludge pits or areas of waste oil for exposure potential.

The different alternatives and the selected remedy in the IROD is not intended to meet any specific ARARs nor is it intended to address any applicable cleanup standards or regulations. This remedy is designed to mitigate a threat posed by the potential migration of waste oil and the contaminated groundwater and limits the environmental factors that contribute to plume migration.

Since the remedy for OU2 has not yet been implemented, the potential threat to human health and the environment, although not an apparent immediate threat, still exists.

Other Comments:

None.

Signature of EPA Regional Administrator or Division Director, and Date

Richard D. Green 9/19/00

Signature Date

RICHARD D. GREEN, DIRECTOR
WASTE MGT. DIVISION

Name and Title

Petroleum Products Corporation
Town of Pembroke Park, Broward County, Florida
Superfund Five-Year Review Report

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List of Abbreviations

ARAR	Applicable, or Relevant and Appropriate Requirements
BCEQCB	Broward County Environmental Quality Control Board
COC	Contaminant of Concern
CY	Cubic Yard
ECT	Environmental Consulting & Technology
E&E	Ecology & Environment
EPA	Environmental Protection Agency
ESD	Explanation of Significant Differences
FDEP	Florida Department of Environmental Protection
FDER	Florida Department of Environmental Regulation
FS	Feasibility Study
GAC	Granular Activated Carbon
GPD	Gallons Per Day
GPM	Gallons per Minute
IROD	Interim Record of Decision
LNAPL	Light Non-Aqueous Phase Liquid
NGVD	National Geodetic Vertical Datum
NPL	National Priorities List
PPC	Petroleum Products Corporation
PRP	Principal Responsible Party
RA	Remedial Action
RD	Remedial Design
RI	Remedial Investigation
TAL	Target Analytical List
TCL	Target Compound List
TIC	Tentatively Identified Compound
TCLP	Toxicity Characteristic Leaching Protocol
TPH	Total Petroleum Hydrocarbons
TRPH	Total Recoverable Petroleum Hydrocarbons
UIC	Underground Injection Control
USACE	United States Army Corps of Engineers

Petroleum Products Corporation
Town of Pembroke Park, Broward County, Florida
Superfund Five-Year Review Report

I. Introduction and Purpose

General

The U.S. Army Corps of Engineers, Jacksonville District (USACE), on behalf of the U.S. Environmental Protection Agency (EPA), Region 4, has conducted a Five-Year Review of the remedial actions implemented at the Petroleum Products Corporation (PPC) Site, Broward County, Florida. This report documents the results of that review. The purpose of this Five-Year Review is to determine whether the remedial actions at the PPC Site remain protective of human health and the environment. The methods, findings, and conclusions of the review are documented in this report.

Authority

This review is required by statute. Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and Section 300.430 (f) (4) (ii) of the National Oil and Hazardous Substance Contingency Plan (NCP), require that periodic (no less than every five years) reviews be conducted for sites where hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure following the completion of remedial actions.

This is the first Five-Year Review for the PPC Site. The trigger for this review is the initiation of remedial action (RA) at the Site, signified by the actual RA start date shown in EPA's CERCLIS/WasteLAN database, August 30, 1995. The actual due date of the first Five-Year Review is August 30, 2000.

Local Repository

A copy of this 5-Year Review Report will be placed in the EPA Region IV Record Center in Atlanta, GA, as well as the local information repository for the PPC Site. The location of the local information repository is:

Broward County Main Library
Governments Document Department - 5th Floor
100 S. Andrews Avenue
Fort Lauderdale, Florida 33301
(305) 357-7444

II. Site Background

The background information presented in this section is a summary and synthesis of material contained in the Interim Record of Decision (IROD) as well as numerous other reports including both pre-remedial and remedial. It is not the purpose of this section to present a detailed description of the Site background, since this has already been accomplished in other reports (see Appendix A).

A. Site Description

Location

- The PPC Site is located approximately 0.2 miles west of Interstate 95 and 1.5 miles north of the Broward County-Dade County Line in Hollywood, Florida.
- The PPC Site is located in the property limits of Town of Pembroke Park, Broward County, Florida.
- The area surrounding the Site is highly developed and contains a high-density residential population in addition to a variety of commercial/industrial activities.

A Site Location Map is presented as Figure 1.

Site Layout

- The PPC Site is an 11-acre parcel of land currently occupied by a commercial/industrial warehouse complex known as the Pembroke Park Warehouses.
- A fenced area in the southeastern portion of the PPC Site is the only area of the previous PPC facility that has been left unpaved.
- The PPC Site is bordered by Pembroke Road to the north, Park Road to the west, Carolina Road to the south, and S.W. 31st Avenue to the east.
- PPC activities as a waste oil re-refiner were mainly confined to the southern half of this property.

A Site Map is presented as Figure 2.

Topography

The PPC Site and vicinity is a flat, low-lying coastal area with shallow depressions. Elevations range from 5 to 8 feet above sea level. Because the Site and vicinity are highly developed, no natural, undisturbed topography remains. Development of the PPC Site and the surrounding area required the importation of large quantities of fill material to build up the originally low-lying area. A topographic survey conducted as

part of the Remedial Investigation indicated that land surface elevations within the warehouse complex may be as much as 4 feet higher than areas south and west of the Site. The highest topographic point at the Site is located approximately 400 feet north of Carolina Avenue.

Drainage and Surface Water

Much of the storm water from the PPC Site flows to a Department of Transportation storm grate on Pembroke Road and ultimately to the Hollywood Canal, discharging to the Atlantic Ocean. Widespread paving at the PPC Site prevents natural storm water infiltration and creates some temporary storm water ponds in low areas. Ponded storm water that does not drain off the pavement ultimately evaporates. Site drainage also consists of a french drain system relieving run-off over the entire property. The french drains are located throughout the Site in addition to drainage wells that are located in the northern third of the Site.

Surface water features in the vicinity of the PPC Site include man-made lakes and the man-made Hollywood Canal. Many of these lakes are borrow pits that were dredged to provide fill material for surrounding areas. Surface water elevations in these lakes and the canal indicated that they are hydraulically connected with the groundwater.

Site Geology and Hydrogeology

The geologic setting of the PPC Site is described in detail in the Remedial Investigation (RI) report (E&E, 1988a) and the Supplemental Remedial Investigation Report (Bechtel, 1992a). A geologic cross-section, which is generally representative of local and on-site geology, is presented as Figure 3. The Biscayne aquifer is directly affected by this Site and this aquifer has been classified as the sole source of drinking water in Broward County. The Biscayne aquifer is part of the Surficial Aquifer System and can be up to 350 feet thick along the coast and thins to the west. The Biscayne aquifer consists of interbedded limestones, sandstones and sands and is very transmissive with transmissivities values generally exceeding 1 million GPD per foot. The regional hydraulic gradients are extremely flat, rarely exceeding 0.0002 ft/ft. The Biscayne aquifer is underlain by a 500 ! 600 foot thick section of Miocene age marls and clay which separates it from the Floridan aquifer. The Biscayne aquifer exists under water table conditions and is recharged by the direct infiltration of rainfall. Water levels are on the order of 5 feet below land surface. Regional groundwater flows to the southeast. Distinct cones of depression associated with the Hollywood and Hallandale well fields may affect site gradients and local flow patterns. Most of the well field production wells are screened at intervals between 50 and 80 feet below land surface, although some screens are set as deep as 152 feet.

The occurrence and movement of groundwater at the PPC Site are influenced by a complex combination of several factors: pumpage at the Hallandale and Hollywood well fields; presence of thick accumulations of relatively impermeable peat and waste sludges that act as barriers to groundwater flow; presence of variable thicknesses of heterogeneous fill material overlying the highly permeable lithologies of the Biscayne aquifer; asphalt or concrete coverage of large portions of the Site, precluding the direct infiltration of rainfall; the presence of local recharge zones as a result of drainage culverts and wells, drain fields, and other unpaved areas; and the presence of lakes around the Site.

B. Site Chronology

History of Operations

The following historical outline is not intended to cover every event but to chronologically highlight some of the major events recorded in file documents.

1958 - PPC commenced operation as a re-refiner of waste oil. Aerial photographs note several tanks were staged in an area bounded on the east and north by large areas of standing water that served as a drainage system.

1966 to 1968 - PPC was experiencing maximum operation as a refinery of waste oils. During this two year period the residents in the area began complaining of overflow of the oils onto the trailer park property located adjacent to and south of the Site.

1970 - PPC initiated major changes in its operation after a large rainfall caused the disposal pit to overflow, producing an oil slick on the trailer park lakes. After increased community pressure at the time of the spill, PPC began preparations to sell the property. The disposal pits were covered with fill.

1971 - PPC ended re-refining operations and began operating as a storage and distribution facility. Warehouses were constructed by PPC on the northern and western sections of the property.

Enforcement and Compliance

May and June 1979 - PPC cleaned up portions of the Site in response to two warning notices from Broward County Environmental Quality Control Board (BCEQRB).

June 1983 - The FDER Southeast Florida District Office issued a Notice of Violations requesting the PPC remove additional waste oils from the Site and submit a detailed sampling analysis plan. PPC hired Dames and Moore, Inc., an

environmental consulting firm, to conduct sampling at the Site. The sampling revealed a layer of waste oil floating on the groundwater table. In addition, the groundwater contained varying amounts of oil and grease, petroleum hydrocarbons, volatile organic compounds, and several inorganic compounds.

June 1984 & The FDER initiated a lawsuit against PPC for violations of statues concerning the handling and disposal of hazardous materials.

October 1984 & The FDER hired Environmental Science and Engineering, Inc. (ESE) to determine the extent of free product at the PPC Site. This report was prepared in December 1984 and is discussed in the following section (Section III.A.)

January 1985 - EPA collected waste oil samples from the storage tanks on-site and an area away from the tanks. The samples exhibited levels of lead (up to 825 ppm), total VOCs (up to 590 ppm) and PCBs.

March 1985 - EPA issued an Administrative Order to PPC. PPC agreed to work under a consent order where PPC would undertake the required cleanup action under the direction of an EPA On-Scene Coordinator. The Order stated that all tanks were to be emptied, cleaned and rendered inoperable; all oil, water and sludges were to be chemically tested prior to disposal; the oil properly disposed of or recycled; and the asbestos in the boiler house removed or encapsulated. Two hundred sixty-two drums of sludge were removed from the property in October, 1985.

1985 - FDER hired a contractor to install a free-product recovery system which consisted of a 30-inch diameter, 23-foot deep extraction well, with a 25 gpm groundwater recovery rate and an oil skimming unit. Approximately 6,900 gallons of waste oil has reportedly been recovered through this large diameter recovery well from 1985 through 1991.

1986 - FDER hired Ecology and Environment (E&E) to perform the RI/FS for the Site.

July 1987 - The Site was placed on the National Priorities List (NPL) based on a Hazard Ranking Score of 40.11.

August 1990 - An administrative hearing officer determined that PPC was eligible to participate in the cleanup program funded by the State of Florida's Inland Protection Trust Fund.

October 5, 1990 - The Interim ROD was signed, identifying Alternative 3 as the recommended remedy.

March 1991 - An Explanation of Significant Differences was issued deferring the modification of the surface drainage system until the final remedy is implemented.

The chronology of the major actions at the PPC Site are summarized in Table 1. The results of site investigations are presented in the next section. A comprehensive listing of site documents is provided in Attachment A.

III. Results of Site Investigations

A. General

Pre-NPL Listing

The results of site investigations conducted prior to NPL listing (July 1987) included: (1) sampling and analysis of groundwater and soils by Dames and Moore in 1984; (2) groundwater sampling by the Broward County Environmental Quality Control Board; (3) a Preliminary Assessment of Free Oil Contamination (ESE, 1984); and (4) sampling by EPA of the storage tanks and soils. A free-floating oil layer was defined in the southeastern portion of the Site and old sludge lagoons. In general, these early investigations resulted in the following:

- a quantity of 20,000 to 60,000 gallons of free-floating oil was estimated to exist at the Site;
- the position of the oil plume suggests that the migration rate is rather slow and the migration pattern is to the east-southeast direction;
- fluctuations of the oil layer with movement of the water table have resulted in extensive saturation of soil by the oil layer;
- Groundwater samples contained varying amounts of oil and grease at the parts per million levels, as well as varying amounts of dissolved volatile organics, organic halocarbons, phenols, PCBs, lead, chromium, and cadmium at the parts per billion level;
- Samples from the tank farm exhibited significant levels of several hazardous compounds.

Information gathered during these early investigations resulted in NPL listing of the Site in July 1987.

NPL Listing (1987) to IROD Signing (1990)

A **Remedial Investigation (RI)** report of the PPC Site was prepared by Ecology and Environment (E&E, 1988a). The primary objectives of the RI were to determine the nature and extent of contamination and to gather the necessary data to support a **Feasibility Study (FS)** for the consideration of remedial alternatives. The types of studies conducted in support of the RI objectives can be categorized as follows: (1) site features investigation, (2) hazardous substance investigation, (3) geologic investigation, (4) soil and water sampling, (5) contaminant source identification, and (6) public health evaluation.

The RI fieldwork was conducted in two phases. Phase I fieldwork was performed from May to August, 1986 and included a soil gas investigation; oil sampling;

surface water and sediment sampling; soil sampling; monitoring well installation; slug testing of monitoring wells; and private well sampling. Phase II fieldwork was performed during February and March 1987. This fieldwork included additional soil sampling; installation and sampling of additional monitoring wells; surface water runoff and culvert drainage well sampling; slug testing of new monitoring wells; and collection of samples for a treatability study. Results of the RI can be summarized as follows:

- soils and groundwater underlying the PPC Site are contaminated with a variety of inorganic and organic compounds. Lead and long-chain aliphatic petroleum hydrocarbons are the predominant soil contaminants;
- extensive soil contamination is restricted to the southern half of the original PPC property. In the disposal pit areas, highly contaminated sludges occur to depths of almost 28 feet;
- lead, chromium, and other organic contaminants exceed Florida groundwater standards in a number of shallow monitoring wells. The shallow groundwater contaminant plumes coincide with the main area of soil contamination and have not migrated very far offsite. The limited extent of contaminant transport is primarily controlled by the relatively flat hydraulic gradient and associated low groundwater flow velocity;
- vertical migration of contaminants into the more transmissive zone of the Biscayne aquifer has occurred. However, the extent of lateral migration within this zone is limited by the very flat hydraulic gradients;
- the onsite drainage culverts and culvert drainage wells provide a direct pathway for contaminants to enter the groundwater system;
- the PPC Site represents a stable system that poses no immediate threat to municipal water supplies.

In March 1988, a **Feasibility Study (FS)** was completed by E&E (E&E, 1988b), which included an evaluation of remedial alternatives and proposed cleanup goals for soil and groundwater. FS results can be summarized as follows:

- five remedial alternatives were screened, using five criteria: (1) technical feasibility, (2) public health (3) environmental, (4) institutional, and (5) cost;
- the recommended remedy was alternative 15C, which included: (1) excavation of process area soil, (2) separation of soil and debris by screening, (3) treatment of the soils by chemical fixation, (4) grinding and washing of any debris found buried at the Site for recycling and (5) treatment of surface water and groundwater by ion medium filtration;
- risk-based soil cleanup goals of 100 mg/kg (lead) and 1,000 mg/kg (TRPH) were proposed;

- potential cleanup criteria for groundwater indicator chemicals (lead, chromium, volatile organics, and benzene) were tabulated;
- the volume of soil requiring treatment was estimated to be 110,280 cubic yards (CY) based upon soil removal to 100 mg/kg lead and 108,060 CY based upon soil removal to 1,000 mg/kg TRPH;

Post IROD Signing

January 1992 - A **Supplemental Remedial Investigation Report (SRI)** was completed by Bechtel Environmental, Inc. (Bechtel, 1992a). The objectives of this supplemental investigation were to better define the boundaries of soil contamination; the nature and extent of groundwater contamination; and to include data about the free-product plume.

June 1992 - A **Baseline Risk Assessment** was prepared by Clement International Corporation (Clement, 1992) for this Site. Direct contact risks from the Target Analytical List (TAL) and Target Compound List (TCL) chemicals in soil resulted in an ingestion risk of $1X10^{-5}$ for future young child residents. The same pathway evaluated for Tentatively Identified Compounds (TICs) in soils resulted in an ingestion risk of $9X10^{-5}$ for the same receptor. Lifetime cancer risks associated with the consumption of onsite groundwater exceed the risk range of $1X10^{-4}$ to $1X10^{-6}$. No significant ecological risk from the PPC Site was predicted to occur.

July 1992 - A **Supplemental Feasibility Study Report (SFS)** was prepared by Bechtel (Bechtel, 1992b). This report reevaluated the five alternatives selected in the FS based upon findings from the SRI, treatability studies, or new regulatory requirements. In addition, a range of supplemental source control alternatives was developed with various treatment/disposal options. The emphasis in the SFS was to assemble alternatives that utilize innovative treatment technologies to the maximum extent practicable in an effort to optimize remediation. The supplemental alternatives are limited to source control actions only and do not incorporate additional response actions for other site media.

This concludes the summary of investigations conducted prior to submittal of the Remedial Design (RD). In the following sections, risks to human health and the environment, the provisions of the IROD, and subsequent remedial actions will be covered.

B. Contaminants of Concern

Contaminants of Concern (COC's) selected by EPA for the PPC Site were those contaminants that posed a threat to human health and the environment. Factors

used in the RI and IROD for the selection of COC's were:

- frequency of detection
- fate and transport
- concentration
- toxicity

C. Potential Pathways for Contaminant Migration and Exposure

The following possible pathways for exposure to humans were identified in the IROD:

- ingestion and dermal adsorption of groundwater from irrigation wells;
- ingestion and dermal adsorption of surface water from surrounding lakes;
- incidental ingestion of soils;
- dermal adsorption of soils;
- inhalation of vapors.

All drinking water in the area is presently provided by the Hallandale or Hollywood well fields according to the RI Report.

D. Summary of Site Risks

Human Risks:

Groundwater: Upperbound excess lifetime cancer risks associated with the consumption of onsite groundwater from surficial depths exceed the risk range of $1X10^{-4}$ to $1X10^{-6}$, and non-cancer risks associated with these exposures also indicate that adverse noncarcinogenic effects could potentially occur. Cancer risks in the surficial groundwater are largely due to the presence of vinyl chloride; a concentration as high as 47 ug/l was measured in the monitoring well BGSW01S. While it is unlikely that this surficial depth would be used for potable purposes, chemicals present in this interval could be of concern if migration were to occur in the future. Lead was found to be the chemical of greatest potential concern at the Site, and consumption of on-site groundwater could be of potential concern to young children under a future residential scenario.

Soils: Direct contact risks from the Target Analytical List (TAL) and Target Compound List (TCL) chemicals in soil did not exceed EPA's remedial risk range of $1X10^{-4}$ to $1X10^{-6}$ for any receptor. However, an evaluation of Tentatively Identified Compounds (TICs) in surface soil/sediment in the Source Area resulted in an ingestion risk of $9X10^{-5}$ for future young child residents. The same ingestion pathway evaluated for TAL and TCL chemicals resulted in a lower risk of $1X10^{-5}$ for

the same receptor. Inhalation risks associated with disturbance of subsurface soil in the Source Area by a utility worker were not quantified at this Site because of the uncertainty surrounding the analytical data.

Ecological Risks:

Few pathways exist by which wildlife species can be exposed to the contamination associated with this Site. The majority of contamination associated with this Site is present in groundwater or in surface and subsurface soils that are under pavement, and thus inaccessible to wildlife. Given the limited habitat value of this Site and surrounding area, wildlife are unlikely to use the PPC Site to any significant degree.

Health Assessment:

In April 1989, the Agency for Toxic Substances and Disease Registry (ASTDR) issued a Health Assessment for the PPC Site. ASTDR recommend off-site testing for lead in the surficial aquifer southwest of the Site should be extended. However, they did not recommend any follow-up health studies because the information on the population at risk was not sufficient to perform a health study.

IV. Summary of Response Actions

A. Overall Cleanup Strategy.

The long-standing cleanup strategy for this Site has involved three operable units. The first operable unit, OU1, is designed to recover as much of the free product as practicable and to contain the migrations of dissolved phase contaminants. The second operable unit, OU2, is to remediate the contaminated subsurface soil and re-refinery acid and clay sludges. The third operable unit, OU3, is to treat any remaining groundwater contamination, after the soil had been treated and is viewed as a contingency remedy, should groundwater treatment be necessary after treatment of soil.

The proposed plan for the first operable unit, OU1, was released to the public in July 1990. A draft IROD for OU1 was proposed incorporating public comments. The selected remedy was Alternative 3 as detailed below in Part C of this section. The IROD for OU1 was issued on October 5,1990 (EPA, 1990).

The proposed plan for the second operable unit, OU2, was released to the public in January 1997. A draft ROD for OU2 was proposed incorporating public comments. The draft ROD addressed soils in the most contaminated portions of the Site, the former sludge disposal pits and tank farm. The selected remedy was Alternate 7 which included in-situ stabilization/soIidification of 131,200 cubic yards of used rerefinery waste with groundwater monitoring. Based on comments received on the proposed remedy, it was concluded that additional time and effort should be invested in accelerating the recovery of additional waste oil from the water table. As a consequence, remedy selection for the Site's soil has been deferred until more waste oil is recovered.

B. Remedy Selection

General

Based upon consideration of the requirements of CERLCA, available data collected, a detailed analysis of alternatives, and public comments, both EPA and the State determined that Alternative 3 was the most appropriate remedy for the PPC Site. The selected remedy, as outlined in the IROD, involved these seven components:

- decommission the non-operating wells that remain on-site;
- close out the storm drainage wells that are on-site;
- post warning signs at the Site;
- prevent access to the concrete dike area in warehouse number 261;

- conduct a private water well survey to identify present users of the groundwater in the effected area;
- modify the present recovery system in an effort to remove a larger volume of oil from the groundwater and contain the plume; and
- provide off-site disposal of the recovered waste oil.

Significant Changes to the Remedy

There have been two significant changes to the selected remedy. In March 1991, the first Explanation of Significant Differences (ESD) document was issued by EPA (EPA, 1991). This ESD modified the existing IROD by deferring the close out of the surface drainage system until the remedy for OU2 is implemented. This was necessary due to the possibility that the OU2 remedy for the PPC Site would require excavation of the contaminated soils near this drainage system, potentially destroying the drainage system. A second ESD document was issued by EPA in 1998. This ESD explained and documented the significant differences in recovery technologies used in the original remedial design and the modified bioslurper system.

C. Remedy Implementation

Remedial Design

The PPC steering committee contracted with Blasland, Bouck & Lee (BBL) to perform Remedial Design activities as outlined in the IROD and ESD. The purpose of the Remedial Design was to develop a design focusing primarily on enhanced free-product recovery. The other items in the IROD have also been addressed in the Remedial Design.

On-site Culvert Drainage Wells.

Although the ESD deferred the close out of the Site surface drainage system, BBL still completed a visual survey of the existing culvert drainage wells. This survey was necessary due to a discrepancy between information in the RI and information provided by the Site owners. This survey concluded that existing culvert drainage wells do not appear to present a direct pathway to the underlying Biscayne aquifer.

Warning Signs.

Warning signs were noted at the Site during BBL's initial site inspection.

Concrete Dike Area in Unit 261.

This unit was closed and locked to preclude future contact with the used oil that has collected. A concrete retaining wall was constructed within the unit to contain the used oil.

Private water well survey and sampling.

One private water well was identified during the survey. This well was designated PWW-2 and is located approximately ¾ mile southeast of the Site in the vicinity of various commercial establishments. Subsequent to this survey, the EPA has identified and sampled four additional private wells, two of which are located on SW 31st Avenue and two of which are located on SW 30th Avenue. Analytical data from PWW-2 indicated the presence of 1,2-dichlorobenzene and 1,4-dichlorobenzene. The detection of 1,2-dichlorobenzene and 1,4-dichlorobenzene have been found in site waste oil and in site soils during historical sampling and may be related to PPC activities. This is a heavily commercialized and industrialized area and these constituents may have also originated from another source. Both of these constituents were not detected in the perimeter wells located between the Site and PWW-2.

Free-Product Recovery Design.

The PPC Site is divided into two zones for the purpose of remediation. Zone 1 encompasses the southern portion of the Site and is characterized by relatively low viscosity used oil. Zone 2 includes the northern portion of the Site and is characterized by relatively high viscosity used oil. Figure 4 shows the location of these two zones.

The recommended design incorporates a groundwater pump and treat system to create limited drawdown in the shallow water table. The resulting depressed groundwater table will induce the flow of used oil to the extraction points. Because the viscosity of the used oil is low in Zone 1, the design recommended an active surface skimming for use in Zone 1. The average viscosity of the used oil is much higher in Zone 2 where active or passive surface skimming would not be feasible. Therefore, frequent hand bailing of each monitoring well was proposed for use in Zone 2.

Zone 1 groundwater recovery system included six recovery wells with a combined design flowrate of 210 gpm. Zone 2 groundwater recovery system included a total of four recovery wells with a combined design flowrate of 120 gpm. Each recovery well was installed to 25 feet below land surface with 20 feet of slot wire wound screen. The capacity of the groundwater recovery system for both zones is 330 gpm. The treatment system for the recovered groundwater consisted of removal of

volatile organics via two air stripping towers followed by activated carbon polishing. Hydrogen peroxide was added to the treatment system because hydrogen sulfide was developing in the oil/water separators and being emitted from the air stripping towers. The recovered groundwater was designed to be disposed of through an infiltration gallery. However, flooding of the galley persisted and an injection well was added for disposal purposes. This injection well is cased to a depth of 85 feet bls with an open borehole to a depth of 110 feet bls. Monitoring well DMW-B is scheduled to be sampled on a quarterly basis to ensure that the existing quality of the injection zone is maintained.

The EPA approved final implementation of the remedial action in September 1994.

Remedial Action

The recovery rate of groundwater and used oil never did approach design rates. Between the startup of the remedial system in 1994 through 1998 the remedial system had recovered approximately 3,500 gallons of used oil. As shown in Figure 5, the recovery rate of used oil was averaging between 60 to 80 gallons per month during most of 1998. This monthly recovery rate was considerably below the 200 to 300 gallons per month recovery rate specified in the remedial design. There was also uncertainty surrounding the actual quantity of waste oil recovered. The PRP's have revised the estimate of waste oil recovered on several occasions. Because of the low rates of waste oil being recovered, it was decided to modify the waste oil recovery system. An innovative technology identified as “Bioslurping” or “Bioslurper” was determined to be more effective at recovering used oil than the existing remedial system.

Revised Free-Product Recovery Design

A second ESD was issued in 1998 to explain and document the significant differences in recovery technologies used by the existing waste oil recovery system and the bioslurper system under design. The vacuum-enhanced bioslurping recovery system proposed by this ESD withdraws groundwater, waste oil and soil gas in one stream, using a single-above ground pump. The extracted oil/water mixture is separated from the waste oil and treated. The treated water is injected back into the aquifer. The soil gas collected by the bioslurper system is discharged into the atmosphere after proper treatment. Recovery of these media through vacuum-enhanced recovery is accomplished by pulling a vacuum on the recovery wells to create a pressure gradient that promotes movement of waste oil into the recovery
wells.

In order to confirm that the bioslurping technology is an effective approach at waste oil recovery, the bioslurping recovery system has been built over approximately half the area known to contain waste oil floating on the aquifer. This will be inside the

fenced compound located at the southern end of the Site. If bioslurping technology is proven to be successful, the second phase of the recovery system will be constructed at the PPC Site that will operate the northern end of the Site.

The Phase 1 system is designed to extract from 60 wells; 44 new extraction wells and 16 existing wells are utilized. Nine soil gas monitoring points are also installed to monitor influence of the remedial system and for soil-gas sampling. This is in addition to the nine monitoring points installed during the pilot-scale bioslurping test. The extraction well locations are shown in Figure 6. The 44 new extraction wells consists of forty 4-inch diameter and four 2-inch diameter wells. In general, the wells are spaced approximately 40 feet apart. A 20-hp liquid ring pump provides the vacuum to extract used oil, groundwater, and soil gas from the subsurface. Water and soil-gas is extracted from the wells into an equalizing tank. The equalizing tank prevents the surging of liquids into the ring pump. From this tank, the vapor is discharged to the off-gas treatment system and the liquid is fed to an oil-water separator. The FDEP has a thermal oxidizer available for use and it was expected, based on preliminary design information, that the thermal oxidizer will be required to treat off-gases for up to six months. The water treatment system consists of an oil-water separator followed by an air stripper. A schematic of the treatment system is provided in Figure 7.

A spill containment structure, consisting of a concrete dike, is installed around the liquid-handling portion of the primary bioslurper system. The volume enclosed by the spill containment dike is approximately 630 cubic feet (approximately one foot high dike in an area of approximately 630 square feet).

The Town of Pembroke Park has a noise ordnance that limits machinery noises between 7:00 p.m. and 6:00 a.m. for a residential district. The sound level limit is 65 decibels for an industrial district at all times. To abate some of the objectionable noises during system operation, a sound-deadening wall was to be constructed to the south of the system units, however, as the liquid ring pump was put into operation, it became apparent that it was not necessary since the unit was quieter than anticipated.

The bioslurper system is designed to operate the extraction of fluids only from the wells that are observed to contain free-product. The 60 extraction wells are divided into a manifold network of eight manifolds. These eight extraction well manifolds have been further divided into four sets, based upon results of free-product thickness during start-up of the bioslurper system. Well rotation is performed when biweekly oil/water measurements are collected. Only wells that contain free-product are selected for use as an extraction well. For each extraction well rotation, five to ten extraction wells are selected from a manifold set. Based on the free-product thickness measurements, the drop tube in the extraction well containing product is set at the oil/water interface.

In December 1998, the waste oil recovery system was turned off and construction of the bioslurper system commenced.

Roles and Responsibilities

Battelle Memorial Institute, Columbus, Ohio is responsible for overseeing the design, installation, startup and design modifications of the bioslurper system. Battelle is under contract with the Navy as the Navy is one of the Potential Responsible Parties (PRP's) at this Site. Long-term operation and maintenance of the bioslurper system is performed by Environmental Consulting and Technology, Fort Lauderdale, Florida. de maximis, Knoxville, Tennessee is the project manager for the PRP's. The EPA is the lead regulatory agency and the FDEP assists EPA in the review of reports. The Broward County Department of Planning and Environmental Protection also assists the EPA in the review of reports and acts as a local source of information. The FDEP provides cost reimbursement of much of the project costs. Representing the PRP's is the law firm of Col, Davidson, Carter, Smith, Salter & Barkett.

QA/QC

Quality assurance/quality control (QA/QC) procedures included regular site visits by EPA and FDEP, and utilizing an EPA contracted company for groundwater sampling. All sampling and testing was conducted in accordance with EPA protocols and/or approved methods.

D. Operation and Maintenance (O&M)

The O&M program for the PPC Site is detailed in the following documents:

- **Final Remedial Action Plan** (Battelle, 1998);
- **Operations, Monitoring and Maintenance Manual** (Battelle, 1999).

The primary objective of the O&M program is to recover free-floating product existing as LNAPL, to the extent practicable so that the lateral migration of LNAPL in the subsurface is minimized.

Some of the routine monitoring requirements are: documenting total hours of system operation, inspecting vacuum at liquid ring pump, inspecting volume of water processed, measuring volume of free-product in storage tanks, and measuring,

sampling and calculating vapor gas flowrate and concentration. Other monitoring activities include: measurement of free-product thickness and water levels in extraction wells prior to rotating extraction wells; extraction well vacuums before and after rotating extraction wells; monthly aeration monitoring, respiration test quarterly; monitoring of TPH, carbon dioxide and oxygen in the vapor stream.

O&M Costs

Much of the costs associated with the operation and maintenance of this system is paid for by the FDEP. Costs are approximately $250,000/ year with approximately $200,000 going to ECT for routine operation and maintenance and $50,000 going to Battelle for design modifications and preparation of monthly reports. The Navy reimburses Battelle for any charges that are over and above FDEP's standard rate. Quarterly groundwater monitoring by EPA's contractor, CDM Federal Programs Corp. costs approximately $20,000 per sampling event.

System Operation

Included in this section are some of the operational highlights of the bioslurper system recorded in chronological order from the initiation of the bioslurper system.

Operation of the bioslurper system commenced on March 6, 1999. Concentrations of total petroleum hydrocarbons (TPH) exceeded the FDEP's reinjection standard of 5 ppm. As a result, the bioslurper system was shut down until a granular activated carbon (GAC) treatment system could be installed to treat the process water. The treatment system was modified from an air stripping tower to two - 1,800 pound vessels of GAC plumbed in series. Another oil/water separator was added to the treatment train. Operation of the bioslurper system resumed on April 6,1999.

Carbon usage during first month of operation was high with breakthrough of the primary unit occurring in 33 days. The filter bags required replacement every two days. After an initial LNAPL recovery rate of 756 gallons during the operation in April, the LNAPL recovery dramatically reduced in May and June. There were also excessive shutdowns during this time period. EPA provided comments addressing these concerns in an August 2, 1999 letter to Battelle.

Battelle responded to these comments by providing a revised procedure for determining free-product recovery volumes and by modifying system electronics so that a greater operating time can be achieved.

EPA provided additional comments on system operation in a September 8, 1999 letter. These comments were to clarify usage of extraction wells and well

configuration for system optimization; to specify weekly, rather than monthly, volume of fuel recovered and hours of operation; and to provide soil/gas respiration test data. Battelle provided a response on October 11 incorporating these comments in future system operations/monitoring. A modified extraction well rotation schedule, based on operational data, is provided in Table 2. Subsequent soil gas data noted that the Site is not oxygen limited. This is different than the pilot study results which demonstrated oxygen limitation.

In September Battelle recommended a design change to the treatment system by adding a 18,000 gallon settling tank upstream of the GAC units. This was approved and installed utilizing an existing tank from FDEP's surplus equipment. EPA sent a letter on October 6 noting spill prevention control concerns with the increase in storage capacity.

A September 20, 1999 letter from Midwest Research Institute (MRI) noted a correlation between water table and product thickness during the operation of the bioslurper system. As water table drops the thickness of LNAPL in the wells increases. Based on this correlation, MRI suggested to operate the bioslurper system in a dewatering mode. The following month MRI recommended that the operators to develop a database to evaluate LNAPL recovery rates versus system configuration. Groundwater extraction rates versus wellhead and system vacuum should also be included in this database.

During a site visit in November 1999 Battelle suggested the initiation of Phase II. However, EPA was reluctant given the short operational period of Phase I and the difficulties of treating recovered groundwater. Battelle, the PRP group and the Navy questioned the continued operation of RW-12 since RW-12 was providing a significant volume of water to the water treatment system without recovering much free product.

Free-product was discovered in the Underground Injection Control (UIC) well in late November. Due to this discovery the bioslurper system has been temporarily taken out of service. Thirty gallons of free-product was removed from the UIC well and the UIC well was sampled for Total Petroleum Hydrocarbons (TPH), volatiles and semivolatiles. The sampling results note all concentrations below the detection limit although there was a slight sheen visible in the purge water. The injection well has been cleaned and is planned on being used again when operations commence.

Because of the dilemma of effectively treating TPH to a concentration below 5 ppm and the latest revelation of discovering free-product in the injection well, Battelle determined to review other alternatives for effectively removing TPH from the recovered groundwater. A treatability study was performed in December 1999/January 2000 which four different alternatives were examined. These alternatives include: chemical treatment combined with dissolved air floatation,

treatment with hydrophobic clay, flow-through centrifugal separation, and in-well separation. Chemical treatment combined with dissolved air floatation was the selected alternative and this treatment system is shown on Figure 8. Approval to commence construction of the dissolved air flotation system with chemical treatment has been granted by EPA and FDEP and this water treatment system should begin operation by mid summer 2000.

V. Summary of Site Visit and Findings

A. General

This Five-Year Review consisted of the following activities: a review of relevant documents (see Attachment A, Documents Reviewed), interviews with the EPA Project Managers and FDEP Project Managers, a site inspection, a visit to the local information repository, and preparation of the Five-Year Review report.

B. Interviews

Mr. Galo Jackson, EPA Region IV Remedial Project Manager through July 1999.

Mr. Jackson was interviewed by telephone on May 25, 2000. Mr. Jackson had been the EPA project manager for several years prior to reassignment. Mr. Jackson stated there are no ARARs specified in the IAROD. Mr. Jackson was asked about the storm drainage system. He stated that the PRPs had questioned the necessity of a storm drain, given the potential for contamination to collect in the storm drains and given the fact that stormwater in the vicinity of the Site is routed to the north of the Site.

Mr. Kevin Misenheimer, EPA Region IV Remedial Project Manager from July 1999 through present.

Mr. Kevin Misenheimer was interviewed by telephone on May 18, 2000 and May 24, 2000. Mr. Misenheimer became the project manager for the Site in July 1999. Kevin noted concerns over the lack of operational time of the bioslurper system. Since he was assigned this project, the bioslurper system operated for only a short period of time before being shut down for system modifications. Kevin stated the sampling costs for two years of quarterly sampling is $200,000.

Mr. John Wright, Florida Department of Environmental Protection (FDEP) Assistant Project Manager.

Mr. John Wright was interviewed by phone on May 18, 2000. Mr. Wright has been involved with the PPC Site since the fall of 1997. John was asked what the O&M costs are for this Site and he provided annual O&M costs at approximately $250,000. Of these costs, $200,000 paid to ECT for routine O&M and $50,000 is paid to Battelle. The Navy reimburses Battelle those costs over and above FDEP rate schedule. John stated that the work order for the dissolved air flotation treatment system was just signed and the system should be installed and operating by August 2000.

Ms. Judy Kean, Florida Department of Environmental Protection (FDEP) Project Manager.

Ms. Kean was interviewed by phone on May 18, 2000. Ms. Kean has been the FDEP project manager for the PPC Site for several years. Ms. Kean believes that continued monitoring with recovery of free-product is the best approach for this Site. A risk assessment should be pursued for the off site contamination at the trailer park.

Mr. Mike Miller, de maximis, Inc.

Mr. Miller provided a guided tour of the PPC Site and was interviewed during the Site inspection on March 21, 2000. Mr. Miller provided information on the history of the Site, the present site status, and on planned future actions. Much of the information gathered is included in this report.

C. Site Inspection

General

The Five-Year Review Site inspection for PPC was held March 21, 2000. The weather was warm and sunny.

The following individuals were in attendance:

1. Mike Miller, de maximis, Inc. , consultant of the PRP group
2. Ed Villano, USACE, Jacksonville District, Project Engineer
3. Glenn Olshefski, USACE, Jacksonville District, Project Engineer
4. Greg Mellema, USACE, Omaha District, 5 Year Review Manager
5. Mark Lefebvre, ECT, Inc.
6. John McNally, Coll Davidson Carter Smith Salter and Barkett, P.A.

Mr. Mike Miller escorted the site inspection party throughout the duration of the site inspection. The following areas or components of the Site were inspected: the open waste oil pit in Warehouse #261, bioslurper system, monitoring and extraction wells, north infiltration gallery, the Phase 2 area, and the security fence. At the time of the site inspection, the bioslurping system was not in operation.

Open Waste Oil Pit

An open waste oil pit was observed inside one of the warehouse buildings adjacent to the Phase 1 area (see Photograph #1). Waste oil is 2 to 3 feet thick in this pit.

The pit serves to illustrate the nature of the product underlying the PPC Site.

Site Security

An 8-foot chain link perimeter security fence with a barb-wire crown was observed on the perimeter of the Phase I system. An additional 6-foot privacy fence was located around the treatment system. Although the Site is located in an area of town with a high rate of vandalism, there have been no observed or reported missing or stolen equipment. There is a security gate for site accessibility and this is kept locked other than at times for site maintenance.

Bioslurping System

The bioslurping system was not operating during the site inspection due to treatment system difficulties. The configuration of the bioslurping system is shown in Figure 7. The components and operation of the system are described elsewhere within this report. Some of the bioslurping piping was installed above grade. Since this piping and system is located within the security fence, there should be a minimal concern with any unauthorized tampering of the bioslurping system.

Monitoring/Extraction Wells

Representative photographs of monitoring and extraction wells observed during the site inspection are provided at the end of this report. Wells which were located outside of the Phase 1 area were either flush-mounted with the asphalt pavement, or recessed within an access pit with a hinged metal cover. The metal cover was unlocked. Extraction wells located within the security fence area were observed to have riser pipes connected to the extraction ports, which were installed within a small open access pit. The top of the riser pipe had a valve which controls the flow rate to the piping which feeds to the manifold area (see Photograph #7). The wells which were observed appeared to be in good condition.

D. Local Information Repository

The local information repository for PPC, Broward County Main Library, located on 100 South Andrews Avenue in Fort Lauderdale, was visited on the same day as the site inspection. The administrative record, consisting of the PA, RI, FS, IROD, and other site documentation, was seen on file.

E. Review of Applicable or Relevant and Appropriate Requirements (ARARs)

An ARAR review was performed for the Site in accordance with the draft EPA guidance document, "Comprehensive Five-Year Review Guidance," EPA 540R-98-050, April 1999.

Documents reviewed for the ARAR analysis:

1. Draft Record of Decision
2. Quarterly Groundwater Report (August 16-20, 1999)
3. Analytical Results of Process Water Samples for the Bioslurper System at the Petroleum Products Corporation Superfund Site, 2 December 1999
4. Monthly Progress Report - November 1999

ARARs Identified in the draft ROD Requiring Evaluation During the Five-Year Review: There were no chemical- or location-specific ARARs identified in the draft ROD. The following action-specific ARARs were identified:

1. Chapter 62-531, Florida Administrative Code (FAC) governing water well contractors in Florida
2. Chapter 62-532, FAC, Water Well Permitting and Construction Requirements
3. Chapter 62-528, FAC, Underground Injection Control
4. Chapter 62-25, FAC, Regulations of Storm Water Discharge
5. Chapter 62-730, FAC, Hazardous Waste, Warning Signs
6. Chapter 62-40, FAC, Water Policy
7. Chapter 62-770, FAC, State Underground Petroleum Environmental Response
8. Chapter 62-522, FAC, Ground Water Permitting and Monitoring Requirements
9. Chapter 62-520, FAC, Ground Water Classes, Standards and Exemptions
10. Chapter 62-302, Surface Water Quality Standards
11. Chapter 62-550, Drinking Water Standards, Monitoring and Reporting
12. Florida Ground Water Guidance Concentrations for use in complying with the criteria requirements of 62-520.040, FAC
13. Storm Water Management and Release, 40 CFR 122 and Broward County Code Section 27-14
14. Underground Injection, 40 CFR 144-147
15. Onsite Activities - 29 CFR 651-678, 1904, 1910, and 1926

In performing the 5-year review compliance with ARARs, only those ARARs addressing risk posed to human health or the environment (i.e., address the protectiveness of the remedy) were reviewed. This is in keeping with current EPA guidance on 5-year reviews. Of the above 15 listed ARARs, the following were evaluated as pertaining to the protectiveness of the remedy:

1. Underground Injection Control (62-528 FAC and 40 CFR 144-147)
2. State Underground Petroleum Environmental Response (62-770 FAC)
3. Surface Water Quality Standards (62-302 FAC)
4. Drinking Water Standards, Monitoring and Reporting (62-550 FAC)

1. Federal and State Underground Injection Control Requirements:

Florida State regulations (62-528, FAC) require monitoring of Class V injection wells. Monitoring parameters and frequency are determined by the State for each well based upon site-specific conditions and contaminants. The specific Petroleum Products Corp. Site injection well monitoring requirements were not available for review. However, the process water analytical results for the bioslurper system were reviewed. The results indicate there is a FDEP limit of 5 ppm TPH established for the Site. Analytical results of reinjection water show exceedances of the 5 ppm level as follows:

Sample ID	Sample Date	TPH (mg/L)
PPC-CV2-6	6/4/99	13
PPC-CV2-9	7/1/99	6.8
PPC-CV2-12	6/24/99	7.1
PPC-CV2-15	11/1/99	8.5

The December 2, 1999 process water analytical report indicates the exceedances are due to GAC being quickly spent and that the water treatment system was shutdown in November 1999 until the treatment system could be modified to address the problem. As of the 5-year review Site visit in March of 2000, the water treatment system was still not operational.

2. State Underground Petroleum Environmental Response (62-770 FAC) Requirements:

Florida State petroleum response regulations establish criteria for removal/remediation of petroleum contaminated soils. As of March 2000, site soils had not yet been remediated. Site soils were shown in the draft ROD risk assessment summary to pose unacceptable risks to human health (primarily for child exposures to lead). More recent sampling of soils at the trailer park to the

south of the Site noted concentrations of benzo(a)pyrene above acceptable levels.

3. Surface Water Quality Standards (62-302 FAC):

There appears to be some impact from site contamination on local surface water bodies. The draft ROD indicates that contaminant levels in the nearby mobile home park lake south of the Site were detected in 1992 at very low levels. Additional sampling of this lake and sediments in December 1999 noted high concentrations of semivolatile Tentatively Identified Compounds (TICs) in a sediment sample. The potential for contaminated stormwater to impact surface water still exist due to the unremediated soils at the Site.

4. Drinking Water Standards, Monitoring and Reporting (62-550 FAC):

Florida State Maximum Contaminant Levels (MCLs) were identified as ARARs in the draft ROD. Based upon three Quarterly Groundwater Reports for the Site, there have been a few exceedances of Florida State MCLs for site contaminants of concern.

Summary of Site Compliance with ARARs:

The Site appears to be in compliance with ARARs identified in the draft ROD with the following exceptions:

- Site soils have not yet been remediated per Florida State petroleum cleanup requirements. The potential exists for contaminated stormwater runoff to exceed State stormwater discharge criteria.
- Reinjected water has periodically exceeded the FDEP limit of 5 ppm TPH. The water treatment system is reportedly being modified to address this issue and has been out of operation since November 1999.

An ARAR review was performed for the Site in accordance with the draft EPA guidance document, “Comprehensive Five-Year Review Guidance,” EPA 540R-98-050, April 1999.

Documents which were reviewed for the ARAR analysis are as follows:

5. Supplemental Feasibility Study (Bechtel, 1992b)
6. Interim Record of Decision, (EPA, 1990)

Potential ARARs:

1. Resource Conservation and Recovery Act (RCRA)

    - 40 C.F.R. Part 265.90: Groundwater Monitoring
    - 40 C.F.R. Part 268 Land Ban: RCRA Land Disposal Restrictions

2. Clean Water Act/Safe Drinking water Act

    - Maximum Concentration Levels (MCL's) and Maximum Concentration Limit Goals (MCLGs)
    - Ambient Water Quality Criteria (AWQC)

3. National Ambient Air Quality Standards (NAAQS)

4. Florida Department of Environmental Regulation (FDER) Water Quality Standards, Chapter 17-3, F.A.C., or Chapter 17-550 (currently Chapter 62-550, F.A.C).

5. FDEP Clean Soil Guidance Concentrations (Chapter 62-770, F.A.C.)

Compliance with ARAR's

The different alternatives and the selected remedy in the IROD is not intended to meet any specific ARARs nor is it intended to address any applicable cleanup standards or regulations. This remedy will mitigate a threat posed by the potential migration of the plume into drinking water wells and limits the environmental factors that contribute to plume migration.

F. Groundwater Sampling

Subsequent to initiation of bioslurping activities, quarterly groundwater sampling commenced in August 1999. Groundwater sampling activities are provided to the EPA under contract with CDM Federal Program Corporation (CDM). There had been quarterly groundwater monitoring during the operation of the pump and treat system but this was temporarily discontinued after the pump and treat system permanently shut down in 1998.

The present groundwater monitoring program includes a total of 25 monitoring wells. Thirteen of these wells are shallow wells, seven are intermediate wells, two are deep wells and three are former recovery wells in the shallow zone from the previous pump and treat system. Table 3 identifies the monitoring wells scheduled for sampling under the groundwater monitoring program. Figure 9 provides a site

location for these 25 monitoring wells. Each monitoring well is being sampled for volatiles under EPA Method 8010/8020, semi-volatiles under EPA Method 8100 and a metal analysis of seventeen different metals. Besides the compounds analyzed under the routine Target Compound List (TCL), the laboratory has also quantified tentatively identified compounds (TICs) for both volatile and semivolatile organics.

In general, data from the first three quarters of sampling demonstrated that groundwater is minimally effected by the source of contamination. These reports show that the majority of the groundwater samples indicate no TCL volatile organics or semivolatile organics above the minimum quantification limit. However, numerous TICs were detected during the November 1999 sampling event.

G. Off-site Sampling

During the first groundwater sampling event in August 1999 additional soil samples were collected at the adjacent trailer park across Carolina Street to the South. In response to requests from trailer park residents, six sampling locations were selected by the EPA project manager. These sample locations are identified on Figure 10. Soil samples were collected from 0 – 1 foot and 1 – 2 foot depths at each location. Each soil sample was analyzed for volatile and semivolatile organics, pesticides, PCBs, and metals. A strong odor of petroleum was noted as soon as the surface of the soil was penetrated during collection of sample PPTP01. Soil sample analytical results indicate semivolatile organics contamination at both depths at all sampled locations.

Concurrent with the second groundwater sampling event in November 1999, additional sediment and surface water samples were collected from the lake located in the northwest corner of the adjacent trailer park across Carolina Street to the South. These two sample locations are shown on Figure 11. Each soil sample was analyzed for volatile and semivolatile organics, and metals. An elevated concentration of 160 mg/kg of diesel range organics was detected in the second sediment sample and both sediment samples had high concentrations of semivolatile organic TICs.

VI. Assessment

The Site is located in a highly urbanized and commercialized area which limits the options for remediating the two former sludge pits in operable unit 2. There are several warehouse bays that are situated directly above the former sludge pits. Many of these warehouse bays are occupied with commercial businesses. Analytical data collected over the years demonstrates that there is a significant volume of waste oil and source material that still exists at this Site. The waste oil and former sludge pits are directly connected to the Biscayne aquifer and the Biscayne aquifer is identified as a sole source aquifer. Several private wells have been identified and sampled in the vicinity of the Site. The two municipal well fields, Hallandale and Hollywood, are located approximately 1 mile east-southeast and approximately 1.5 miles northwest of the Site, respectively.

Remediation of the waste oil plume has been going on since 1994 although there has been several periods of downtime during these six years of operation. The original design included a groundwater recovery system for groundwater containment and depression with another system for the recovery of used oil. The recovery system was divided into two separate zones based on the viscosity of the used oil. Used oil in Zone 1 was lighter (lower viscosity) and the recovery included an active skimmer system placed in each groundwater recovery well. Used oil in Zone 2 was heavier (higher viscosity) and the recovery involved manually bailing of used oil formed in the well. After a few years of operating this system it was determined that the rate of recovering used oil was not approaching the design values and another remedial method was proposed by the PRP's to replace this system. An innovative technology identified as "Bioslurping" was selected as the replacement technology. After a pilot study and remedial design was completed the bioslurping system was installed in Zone 1 with Zone 2 system to be installed at a later date. The bioslurping system began to operate in March 1999. There have been several operational problems since the commencement of operations. These involve electrical problems, problems with the continued operation of the catalytic-oxidizer unit, problems with accurately measuring the volume of LNAPL recovered, and problems with effectively treating groundwater to the appropriate standards prior to reinjection. In November 1999, waste oil was discovered in the injection well and the bioslurping system has been inoperable since this time. The cumulative volume of waste oil recovered during the operation of the bioslurper system is shown on Figure 12. Redesign of the treatment system includes a dissolved air flotation unit with chemical treatment. It is expected that the bioslurping system will recommence operations in mid summer 2000.

Many of the operational problems have been or are being addressed through modifications in the recovery and treatment of the oil/water slurry mixture. A treatability study has provided the necessary concentrations of chemicals (ferric

chloride, sodium hydroxide, and a polymer) to generate the desired floc for the dissolved air flotation process. The estimated volume of sludge generated during the dissolved air flotation process is 0.003029 gallons of sludge per gallon of treated water. This estimate is based on a similar treatment process used at another site and will vary somewhat based on influent concentrations. Applying this estimate to the operation of the bioslurper system in 1999, the volume of groundwater extracted was 2,5900,000 gallons. Based on the 0.003029 sludge/groundwater ratio, this will produce approximately 8,000 gallons of sludge. This volume of sludge generated in this process is greater than three times the cumulative volume of LNAPL recovered during the same operational period.

VII. Deficiencies

The following deficiencies were discovered during the Five-Year Review. These deficiencies are broken into several different categories. These include: potential exposure; design implementation; bioslurping operation; and public awareness.

1. Potential exposure

a. Soil contamination at trailer park. Recent soil sampling data collected at the trailer park to the south of PPC, across Carolina Street, noted contaminant levels above the FDEP's Soil Cleanup Target Levels. Soil sample PPTP03A and the estimated value of several other soil samples exceed the residential soil cleanup guidance concentration of 100 ug/kg for benzo(a)pyrene. A strong petroleum odor was noted in the subsurface of sample PPTP01.

b. Sediment contamination in trailer park lake. Recent sediment sampling in trailer park lake across Carolina Street noted high concentrations of semivolatile organic TICs. A letter from a concerned citizen noted that this lake is used for recreational purposes.

c. Warehouse bays. Several occupied warehouse bays are situated directly above the two former sludge pits. There is a possibility that direct exposure to sludge pits may become apparent in due time as a result of cracks in slab or other pathways of exposure.

2. Design Implementation

a. Phase II remediation. The information collected during the bioslurper pilot study was a part of the Phase I area. No design data has been collected for the Phase II area which has a much higher viscosity than the Phase I area. From the information reviewed, it is not known if used oil recovery for Phase II is implementable.

3. Bioslurping Operation

a. Radius of Influence. Extraction wells have been installed at a distance of 40 feet from each other based upon pilot study information. From the information reviewed, it is not known if the extraction wells have a radius of influence of 20 feet as estimated in the design.

b. Oil-Water Separation. The original design and modifications to this design have not achieved the proper treatment of groundwater prior to injection. The discovery of free-product in the injection well has temporarily suspended operation of the bioslurper system.

c. Quantifying Recovered Used Oil. The first few monthly operational reports noted errors in accurately measuring volume of used oil recovered.

4. Public Awareness

a. Update library information. A copy of the administrative record was seen on-file at the local information repository during the March 2000 site inspection. No documentation more recent than 1997 was seen on file.

b. Posting of signs. Signs were not posted by the trailer park warning residents and other interested parties of contamination discovered at the trailer park.

VIII. Recommendations

The following recommendations are made to address the four subject deficiencies noted above. In addition, there are several other recommendations noted under Item 5.

1. Potential exposure

a. Soil contamination at trailer park. Perform additional soil assessment to determine limits of soil contamination. Perform a risk assessment of soils at the trailer park. Remediate these soils to levels acceptable for residential exposure.

b. Sediment contamination in trailer park lake. Perform additional sampling of sediments and perform risk assessment if contaminant levels warrant.

c. Warehouse bays. Perform a periodic evaluation of warehouse bays to determine condition of slab and other structures that are in contact with the sludge pits. Repair any structures that could potentially provide an exposure pathway.

2. Design Implementation

a. Phase II remediation. Perform additional analyses of the used oil in the Phase II area by collecting samples and determining the viscosity of these samples. Evaluate the feasibility of bioslurping technology on high viscosity fluids. Determine where the limits of bioslurping technology are in relation to extracting high viscosity fluids.

3. Bioslurping Operation

a. Radius of Influence. Determine the influence of the extraction wells through the vadose zone and saturated zone. Determine if used oil located near the mid-point of the extraction wells are being influenced by the extraction wells. Evaluate why oxygen was utilized during the pilot study but is not being utilized in the operational mode.

b. Oil-Water Separation. A modification to the treatment system will be implemented this summer. The design will consist of chemical treatment combined with dissolved air flotation. Treatability study results have shown that this system, when adjusted with the proper quantity of chemicals additives, can remove greater then 95% TPH.

c. Quantifying Recovered Used Oil. Methods to measure recovered used oil on a consistent basis have been recommended by Battelle in a August 9, 1999 letter. Utilize this method once system is in operation.

4. Public Awareness

a. Update library information. Provide copies of all site-related information in the local repository. Perform annual review of local repository to determine if any documents are missing from the repository.

b. Posting of signs. Warning signs should be posted along Carolina Street notifying the general pubic of the contaminated soils in the subsurface and to preclude residents from digging.

5. Additional Recommendations

a. Technical Evaluation of Data. Continue to utilize Midwest Research Institute to perform a technical evaluation of bioslurping data. This company has provided relevant and useful comments on the monthly reports submitted by Battelle.

b. Bioslurper System Optimization. PRP contractor personnel should continue to optimize bioslurper system. This would include, but not limited to, evaluating different well rotation schedules and well combinations and modifying the vertical depth of extraction tubes.

c. Treatment System Modifications. Disposal of sludge should be evaluated to determine if the previous free product disposal option is appropriate. Continuous monitoring the final effluent of TRPH with telemetry should be considered.

d. Frequency of Groundwater Monitoring. Quarterly monitoring is the scheduled monitoring frequency during remediation. The monitoring results to date note minimal variation in monitoring results for the first three quarters of monitoring. The monitoring of the groundwater is a costly expenditure with EPA spending over $20,000 per sampling event. Reduce the frequency of groundwater monitoring from quarterly to semi-annual after collecting one year of baseline data. The frequency of groundwater monitoring should be adjusted according to sampling data. If, for example, a sampling event indicates a contaminant plume migrating off-site, the sampling frequency should revert back to quarterly. The frequency of groundwater sampling should be evaluated every year.

e. Number of groundwater monitoring wells. Presently there are 25 monitoring wells being sampled under the monitoring schedule with most of these wells being installed at the surface or in the intermediate zone. With the cost of monitoring running at over $20,000 per sampling event, consideration should be towards reducing the quantity of monitoring wells.

f. Evaluate site drainage system. Evaluate the site drainage system to determine whether or not site drainage system requires modifications.

g. Sound barrier. Review the decibel level whenever new equipment is installed to determine if the noise generated is within the Town of Pembroke Park's allowable range. Add sound barrier if noise level exceeds allowable limits.

IX. Protectiveness Statement

The selected remedy is expected to be protective of human health and the environment although there are potential exposure concerns in the trailer park south of Petroleum Products Corporation and the warehouse bays overlying areas of waste oil.

The selected remedy, as executed, provides an innovative approach to recovering used oil. Reinjected water has periodically exceeded the FDEP limit of 5 ppm TPH. The water treatment system is being modified to address this issue and has been out of operation since November 1999. The bioslurper system should recommence operation by late-summer 2000.

Recent soil sampling data collected at the trailer park located south of PPC, across Carolina Street, noted contaminant levels above the FDEP's Soil Cleanup Target Levels. Recent sediment sampling at the trailer park lake across Carolina Street noted high concentrations of semivolatile organic TICs. There is a possibility that direct exposure to the former sludge pits or waste oil may occur due to cracks in slab, dissolving of the asphalt by the waste oil, or other pathways of exposure yet unrecognized.

Additional assessment should be performed at the trailer park located south of the Site and any warehouse bays overlying the two former sludge pits or areas or waste oil for exposure potential.

The different alternatives and the selected remedy in the IROD is not intended to meet any specific ARARs nor is it intended to address any applicable cleanup standards or regulations. This remedy is designed to mitigate a threat posed by the potential migration of waste oil and contaminated groundwater and limits the environmental factors that contribute to plume migration.

Since the remedy for OU2 has not yet been implemented, the potential threat to human health and the environment, although not an apparent immediate threat, still exists.

X. Next Review

This is a statutory site that requires ongoing Five-Year Reviews as long as hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure. The presence of contamination prohibits unlimited use of the Site. Therefore, ongoing 5-year reviews are required. EPA Region IV should conduct the next review within five years of the signature date of this report.

Figures

Figures

Note: These figures were taken from the following documents:

Figure 1 - Site Location Map: Ecology and Environment, Inc. Remedial Investigation, March 1988

Figure 2 - Site Map: Ecology and Environment, Inc., Remedial Investigation, March 1988

Figure 3 - Geological Cross-Section: Bechtel Environmental, Inc. Supplemental Remedial Investigation Report, January 1992

Figure 4 - Location of Zone 1 and Zone 2: Blasland, Bouck & Lee, Remedial Action Work Plan, July 1993

Figure 5 - Used Oil Recovery Rate During Pump and Treat Operation: EPA, Explanation of Significant Differences, August 1998

Figure 6 - Location of Bioslurper Extraction Wells: Battelle, As-Built Drawings, January 2000.

Figure 7 - Schematic of Bioslurper Process Equipment: Battelle, Final Remedial Action Plan, October 1998

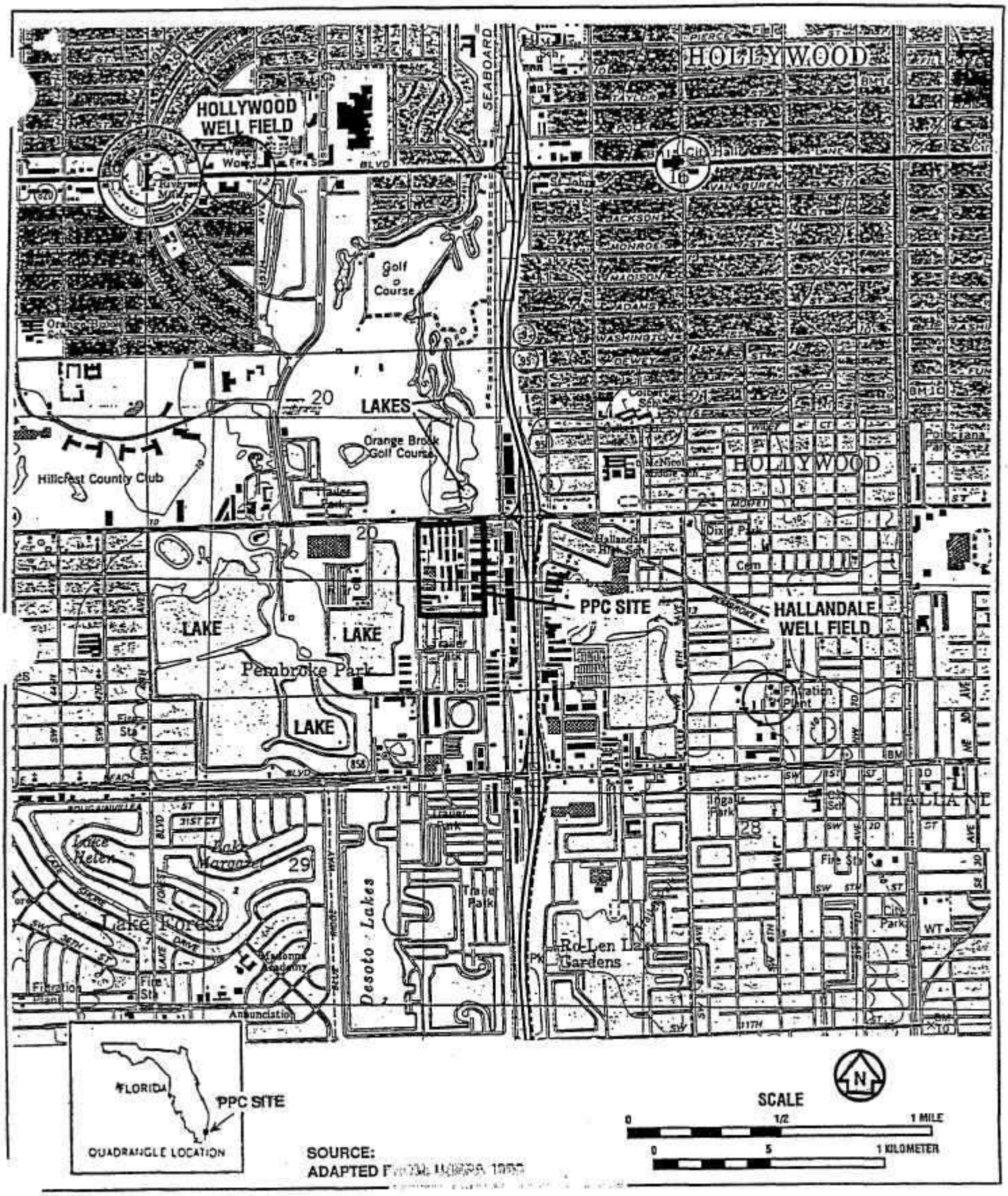
Figure 8 - Schematic of Chemical Reaction Flocculation and Dissolved Air Flotation Treatment System: Battelle, Proposed Work Order, March 2000

Figure 9 - Monitoring Well Locations: CDM Federal Programs Corporation, Quarterly Groundwater Monitoring Report, November 1999

Figure 10 - Off-site Soil Samples: CDM Federal Programs Corporation, Quarterly Groundwater Monitoring Report, November 1999

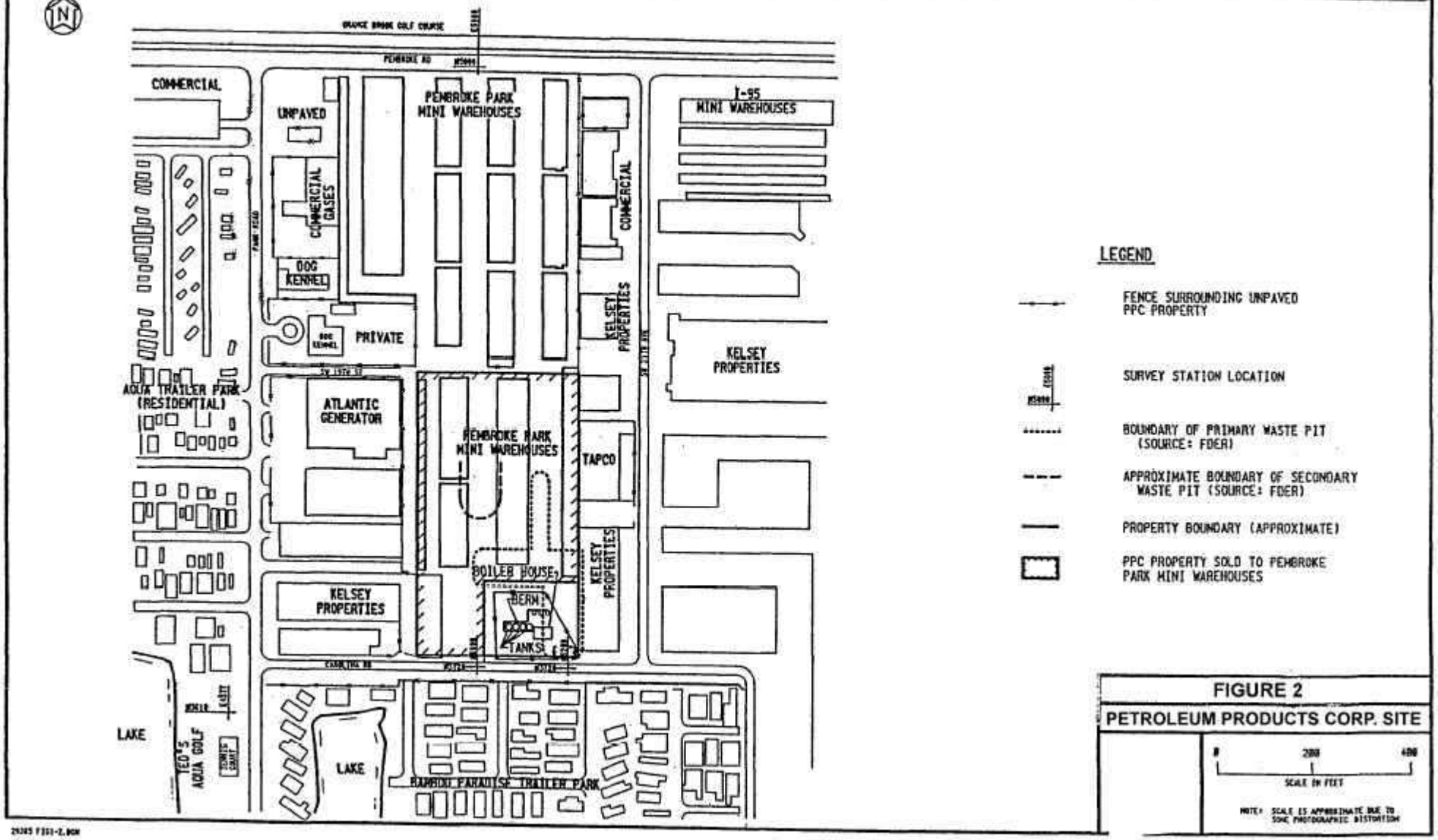
Figure 11 - Off-site Lake Samples: CDM Federal Programs Corporation, Quarterly Groundwater Monitoring Report, March 2000

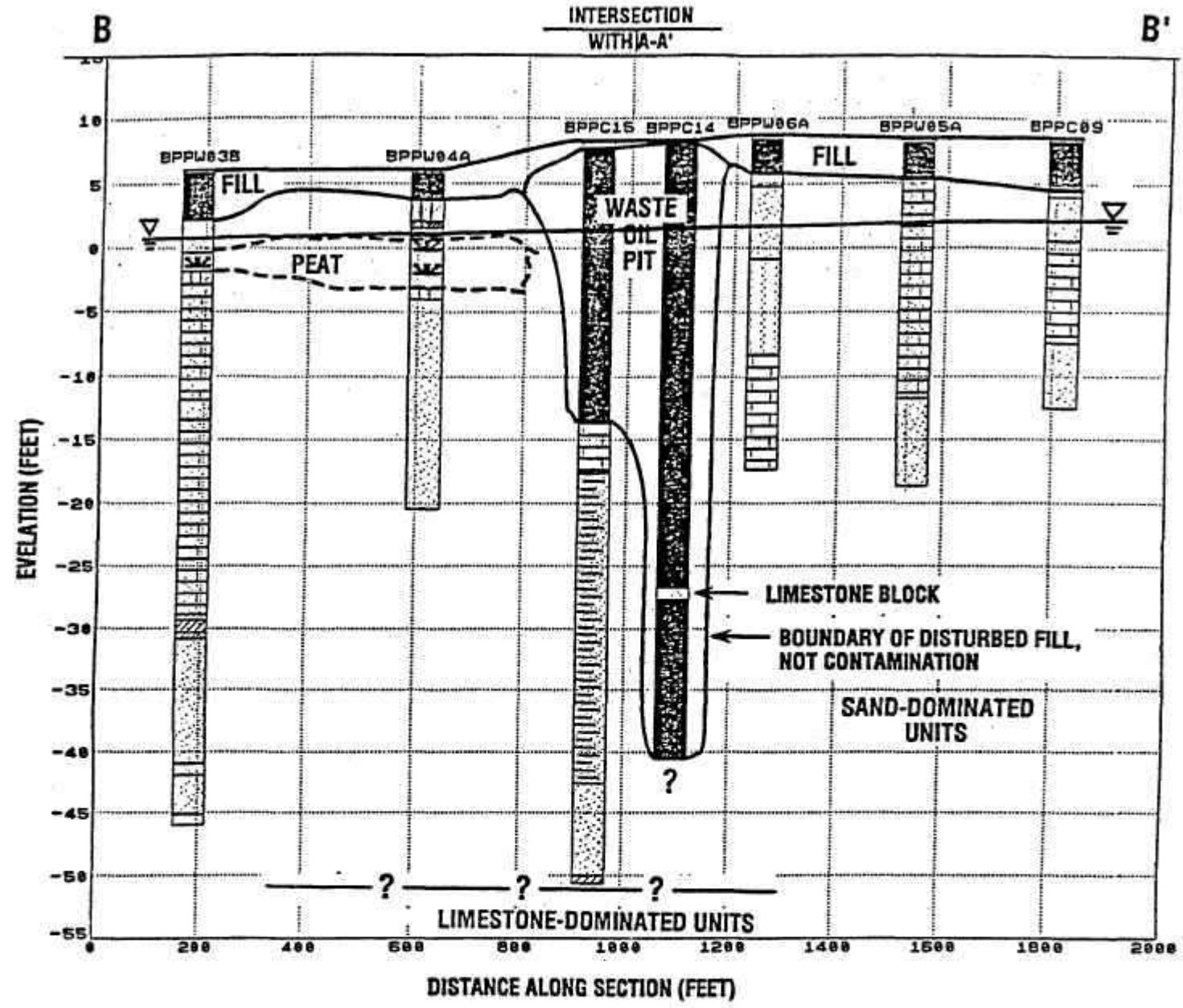
Figure 12 - Cumulative Volume of LNAPL Recovered: Battelle, Monthly Report, December 1999

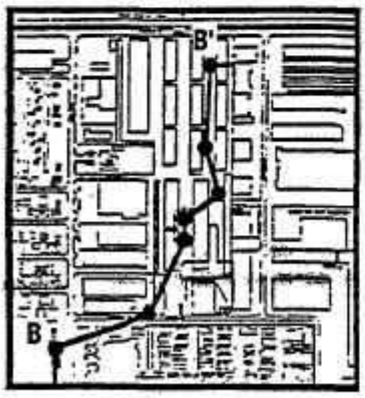


4 2 4012.1

FIGURE 1
LOCATION OF PETROLEUM PRODUCTS CORPORATION (PPC) SITE
PEMBROKE PARK, FL.


N
ORANGE BROOK GOLF COURSE
PEMBROKE RD
COMMERCIAL
UNPAVED
PEMBROKE PARK MINI WAREHOUSES
I-95 MINI WAREHOUSES
COMMERCIAL GASES
DOG KENNEL
PRIVATE
COMMERCIAL
KELSEY PROPERTIES
KELSEY PROPERTIES
SW 15TH ST
AQUA TRAILER PARK (RESIDENTIAL)
ATLANTIC GENERATOR
PEMBROKE PARK MINI WAREHOUSES
TAPCO
KELSEY PROPERTIES
BOILER HOUSE
BERM
TANKS
KELSEY PROPERTIES
LAKE
TED'S AQUA GOLF
LAKE
RAINBOW PARADISE TRAILER PARK
LEGEND
FENCE SURROUNDING UNPAVED PPC PROPERTY
SURVEY STATION LOCATION
BOUNDARY OF PRIMARY WASTE PIT (SOURCE: FDER)
APPROXIMATE BOUNDARY OF SECONDARY WASTE PIT (SOURCE: FDER)
PROPERTY BOUNDARY (APPROXIMATE)
PPC PROPERTY SOLD TO PEMBROKE PARK MINI WAREHOUSES
FIGURE 2
PETROLEUM PRODUCTS CORP. SITE
0
200
400
SCALE IN FEET
NOTE: SCALE IS APPROXIMATE DUE TO SOME PHOTOGRAPHIC DISTORTION





Section Location

NOTES:

- Water level measured 9/21/90
- Waste Pit boundary is not the same as contamination boundary.
- Vertical Exaggeration X22

FILL

ORGANIC SAND

PEAT

CALCAREOUS SANDSTONE

SANDY (DOLOMITIC) LIMESTONE

CLAYEY SAND

SAND/SANDSTONE

Figure 3
Geologic Section B - B"

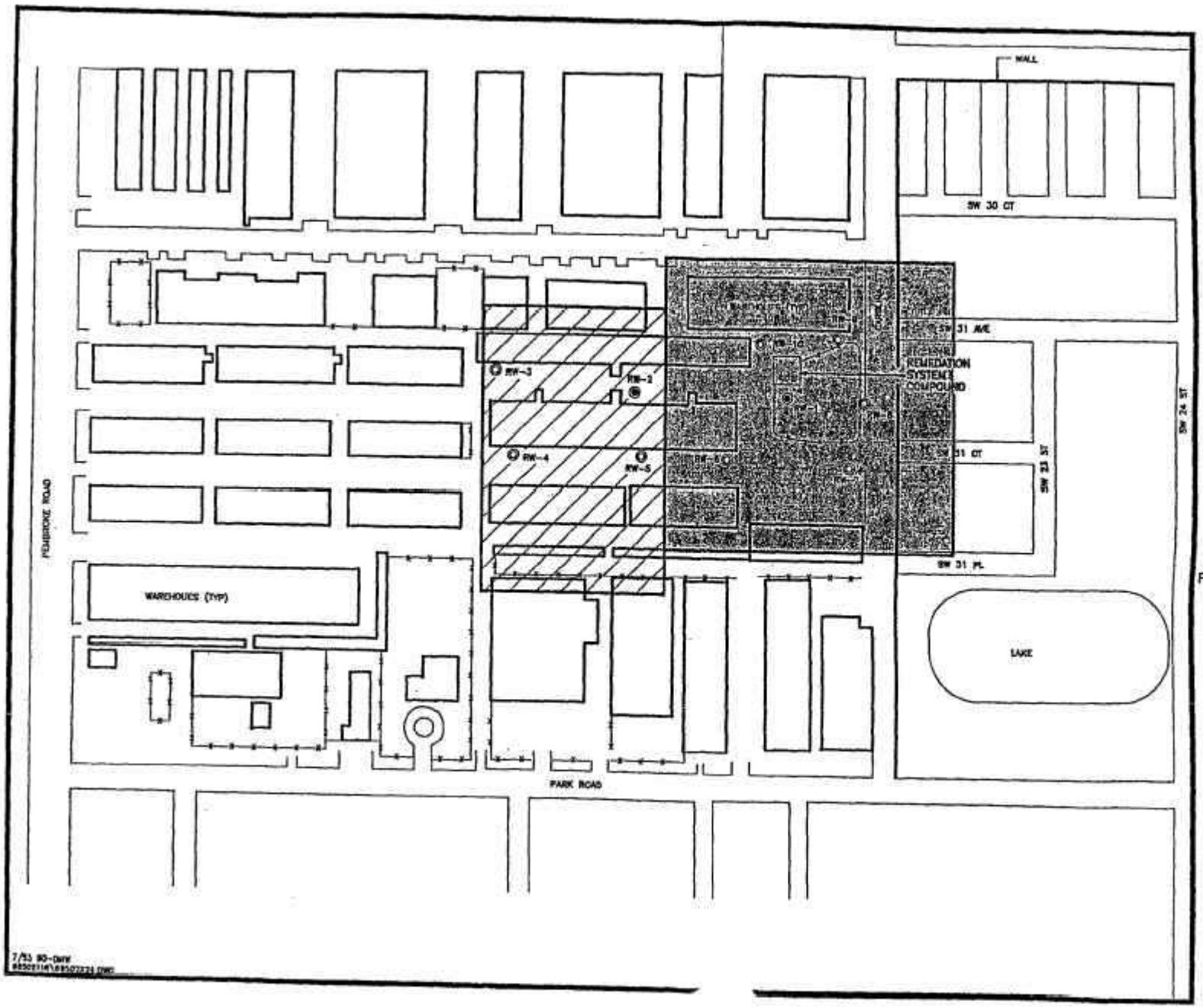


FIGURE 4

LEGEND

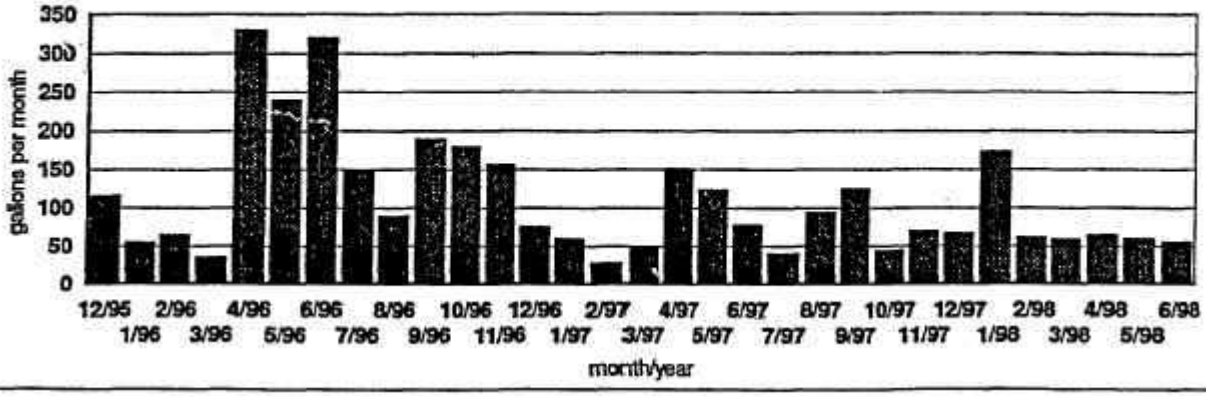
- FENCE
- PROPOSED RECOVERY WELL
- EXISTING RECOVERY WELL
- ZONE 1
- ZONE 2

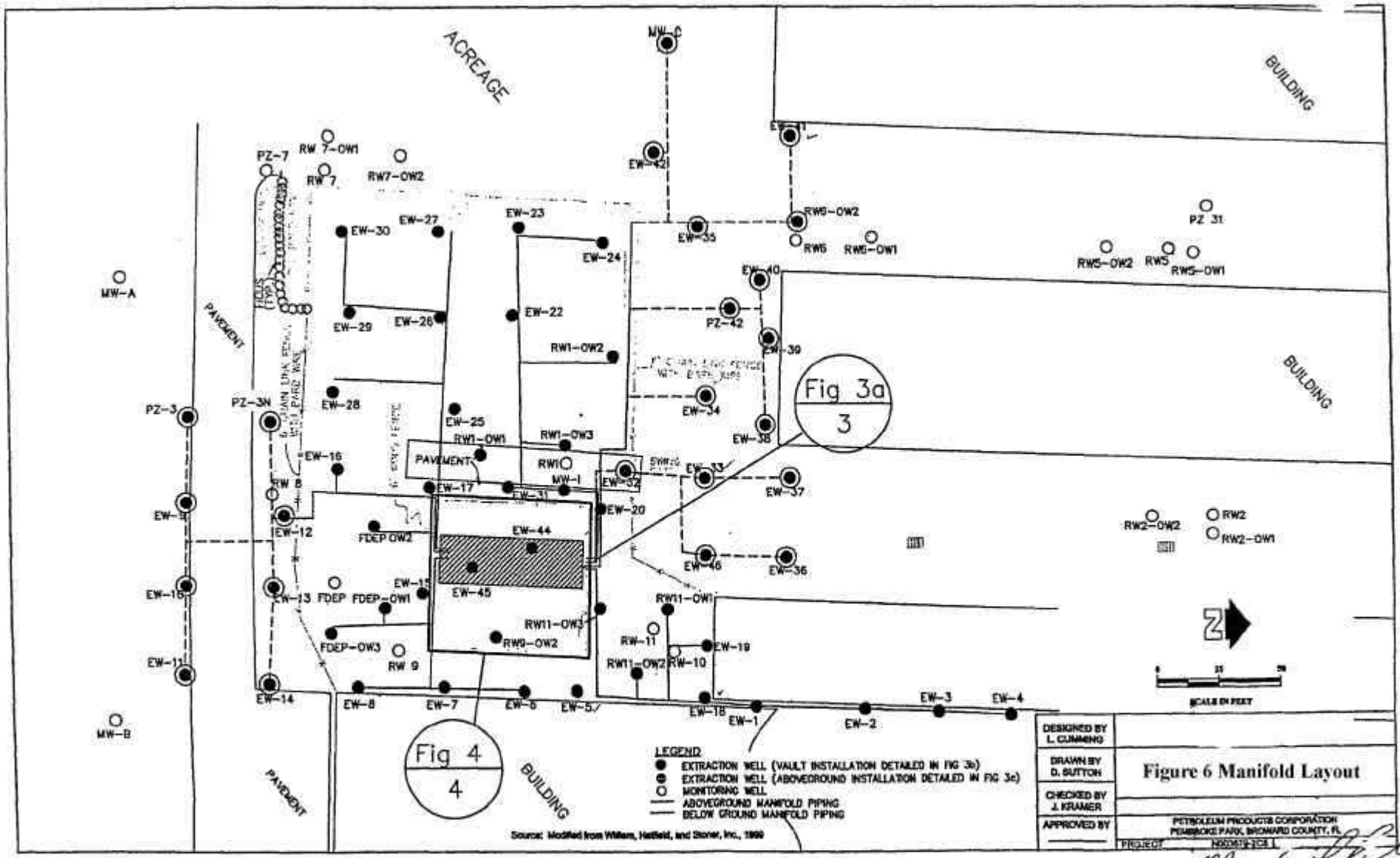
PETROLEUM PRODUCTS CORPORATION
SUPERFUND SITE
PROJECT #68502
PEMBROKE PARK, FLORIDA

SITE MAP WITH RECOVERY WELLS

SCALE IN FEET
150 0 150

Figure 5: Rate of Waste Oil Recovery: Petroleum Products Corporation




ACREAGE
BUILDING
PAVEMENT
MW-A
MW-B
MW-C
PZ-7
RW 7-OW1
RW 7
RW7-OW2
PZ-3
PZ-3N
EW-30
EW-27
EW-23
EW-24
EW-29
EW-26
EW-22
RW1-OW2
EW-28
EW-25
RW1-OW1
RW1-OW3
RW1
MW-1
EW-16
RW 8
EW-17
EW-31
EW-32
EW-20
EW-12
FDEP OW2
EW-44
EW-45
EW-15
EW-13
FDEP
FDEP-OW1
FDEP-OW3
RW 9
RW9-OW2
RW11-OW3
RW11-OW1
RW-11
RW-10
EW-19
EW-14
EW-8
EW-7
EW-6
EW-5
EW-18
EW-1
EW-2
EW-3
EW-4
EW-42
EW-35
RW5-OW2
RW5
RW5-OW1
PZ 31
EW-40
PZ-42
EW-39
EW-34
EW-38
EW-33
EW-37
EW-46
EW-36
RW2-OW2
RW2
RW2-OW1
Fig 3a
3
Fig 4
4
N
SCALE IN FEET
LEGEND
EXTRACTION WELL (VAULT INSTALLATION DETAILED IN FIG 3b)
EXTRACTION WELL (ABOVEGROUND INSTALLATION DETAILED IN FIG 3c)
MONITORING WELL
ABOVEGROUND MANIFOLD PIPING
BELOW GROUND MANIFOLD PIPING
Source: Modified from Willem, Hatfield, and Stoner, Inc., 1999
DESIGNED BY L. CUMMING
DRAWN BY D. SUTTON
CHECKED BY J. KRAMER
APPROVED BY
Figure 6 Manifold Layout
PETROLEUM PRODUCTS CORPORATION
PEMBROKE PARK, BROWARD COUNTY, FL
PROJECT

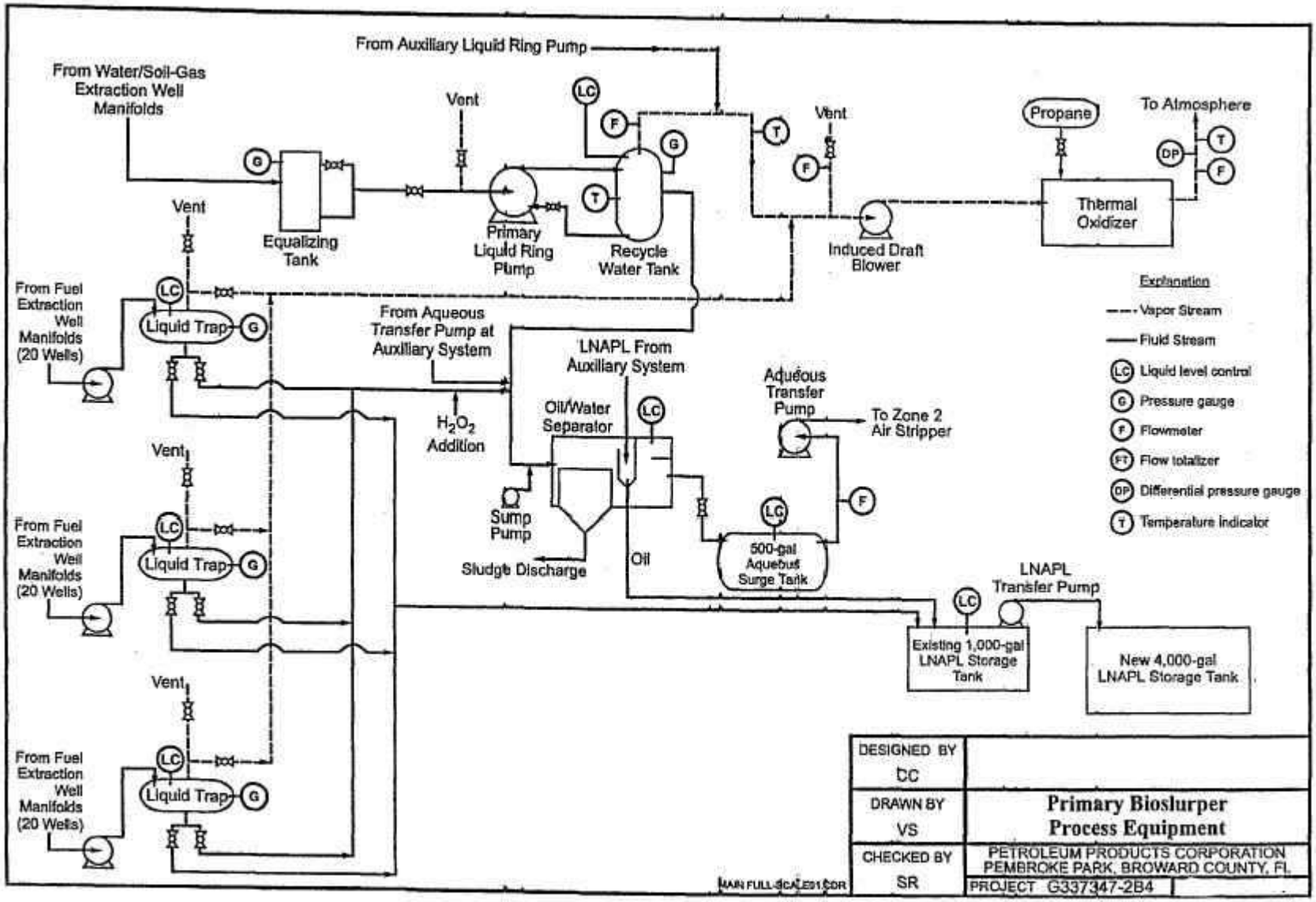


Figure 7. Primary Bioslurper Process Equipment

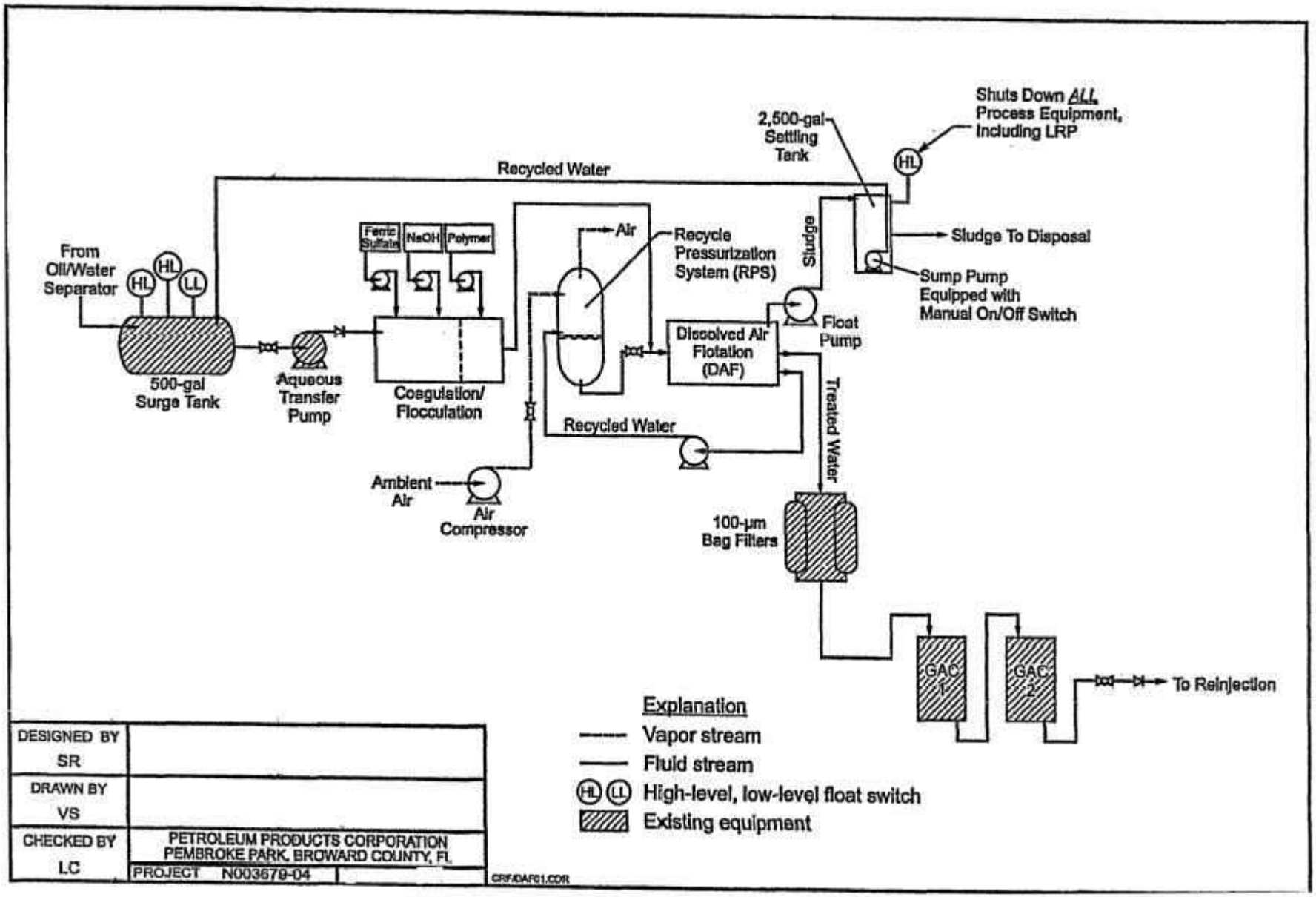
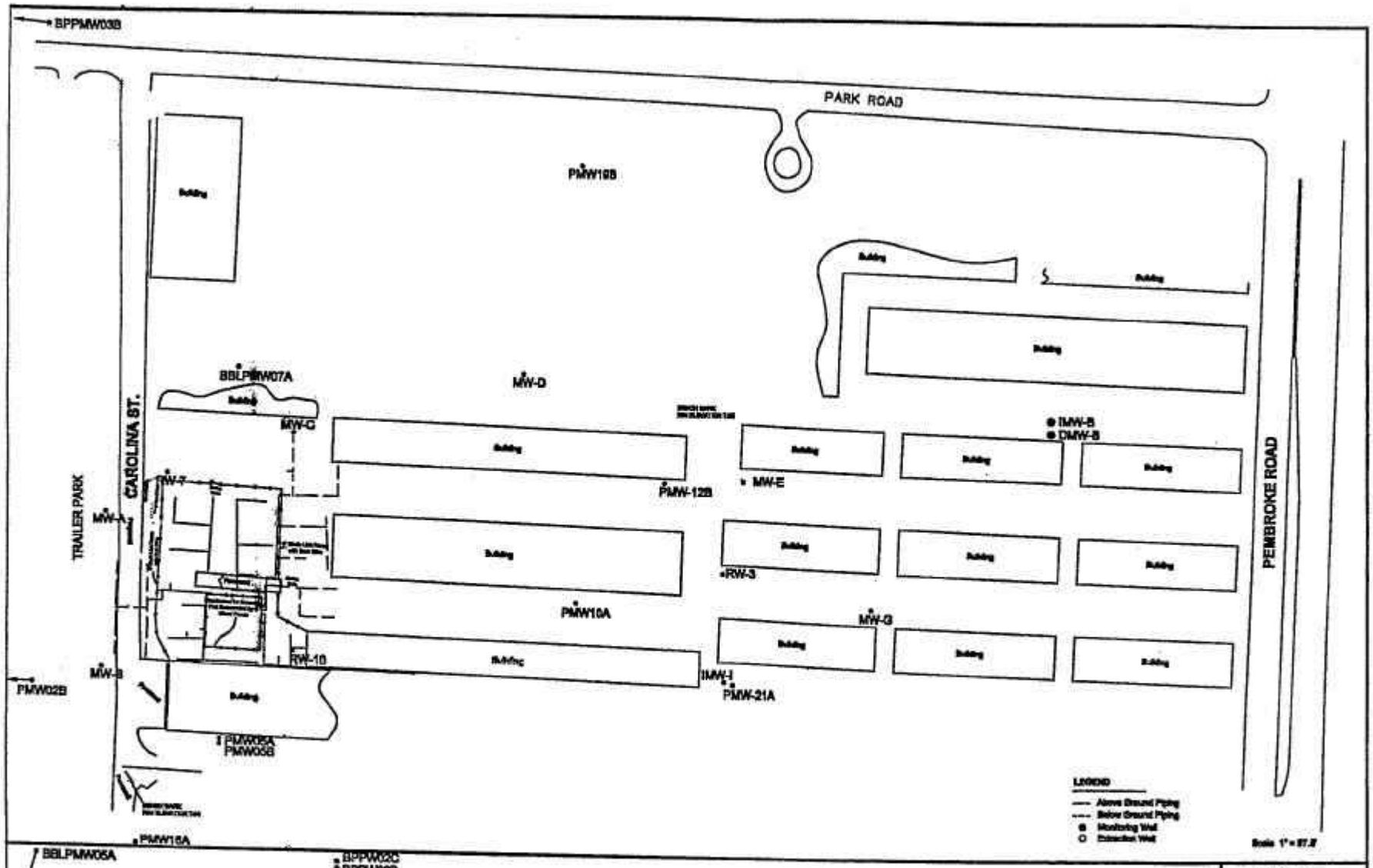

Shuts Down ALL Process Equipment, Including LRP
2,500-gal Settling Tank
Recycled Water
Sludge To Disposal
Sump Pump Equipped with Manual On/Off Switch
Sludge
Float Pump
From Oil/Water Separator
HL
HL
LL
Ferric Sulfate
NaOH
Polymer
Air
Recycle Pressurization System (RPS)
Dissolved Air Flotation (DAF)
500-gal Surge Tank
Aqueous Transfer Pump
Coagulation/ Flocculation
Recycled Water
Treated Water
Ambient Air
Air Compressor
100-µm Bag Filters
GAC 1
GAC 2
To Reinjection
Explanation
Vapor stream
Fluid stream
High-level, low-level float switch
Existing equipment
DESIGNED BY SR
DRAWN BY VS
CHECKED BY LC
PETROLEUM PRODUCTS CORPORATION
PEMBROKE PARK, BROWARD COUNTY, FL
PROJECT N003679-04
CRF/DAF01.CDR

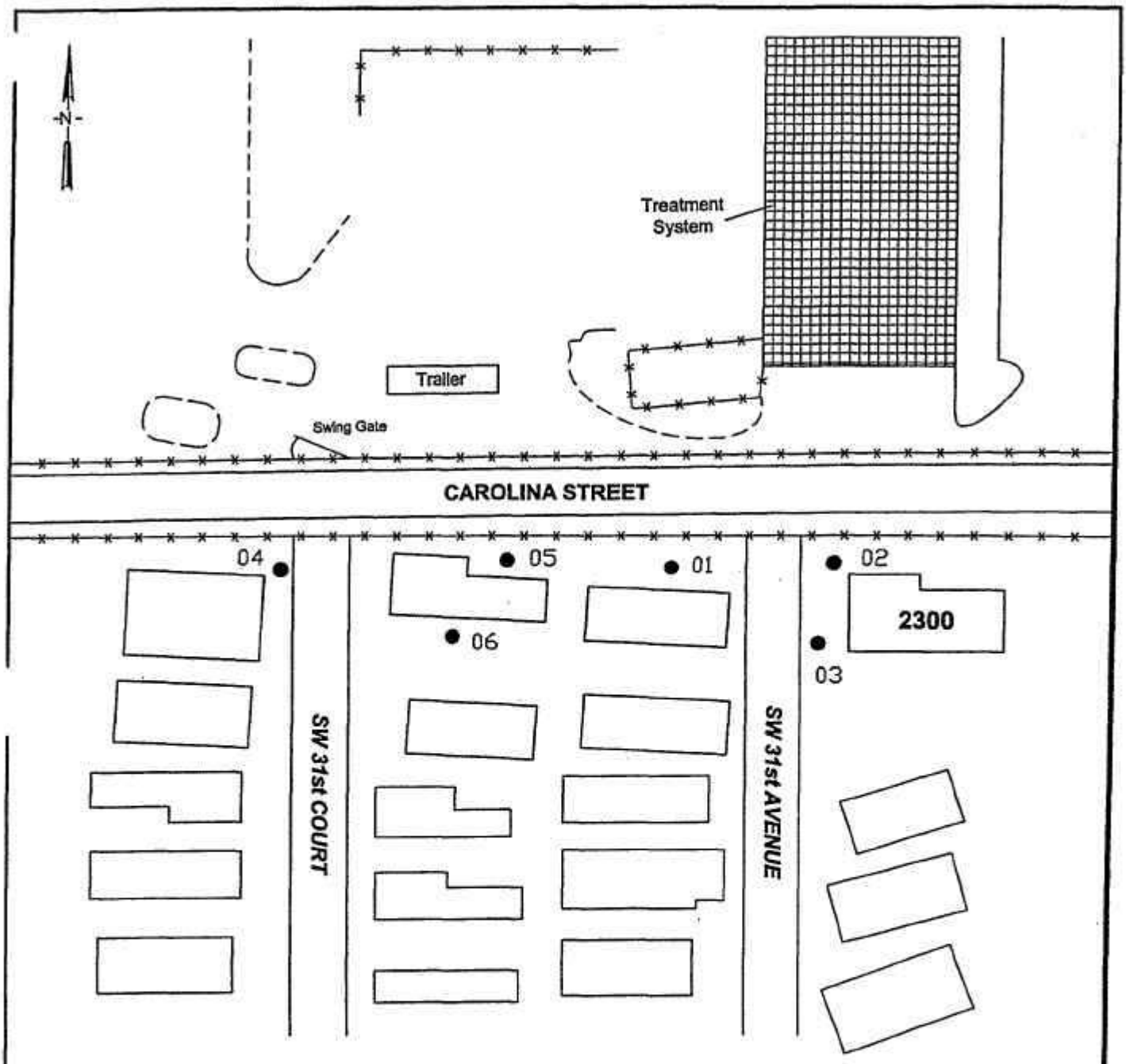
Figure 8



MONITORING WELL LOCATIONS
PETROLEUM PRODUCTS
BROWARD COUNTY, FLORIDA

FIGURE NO.

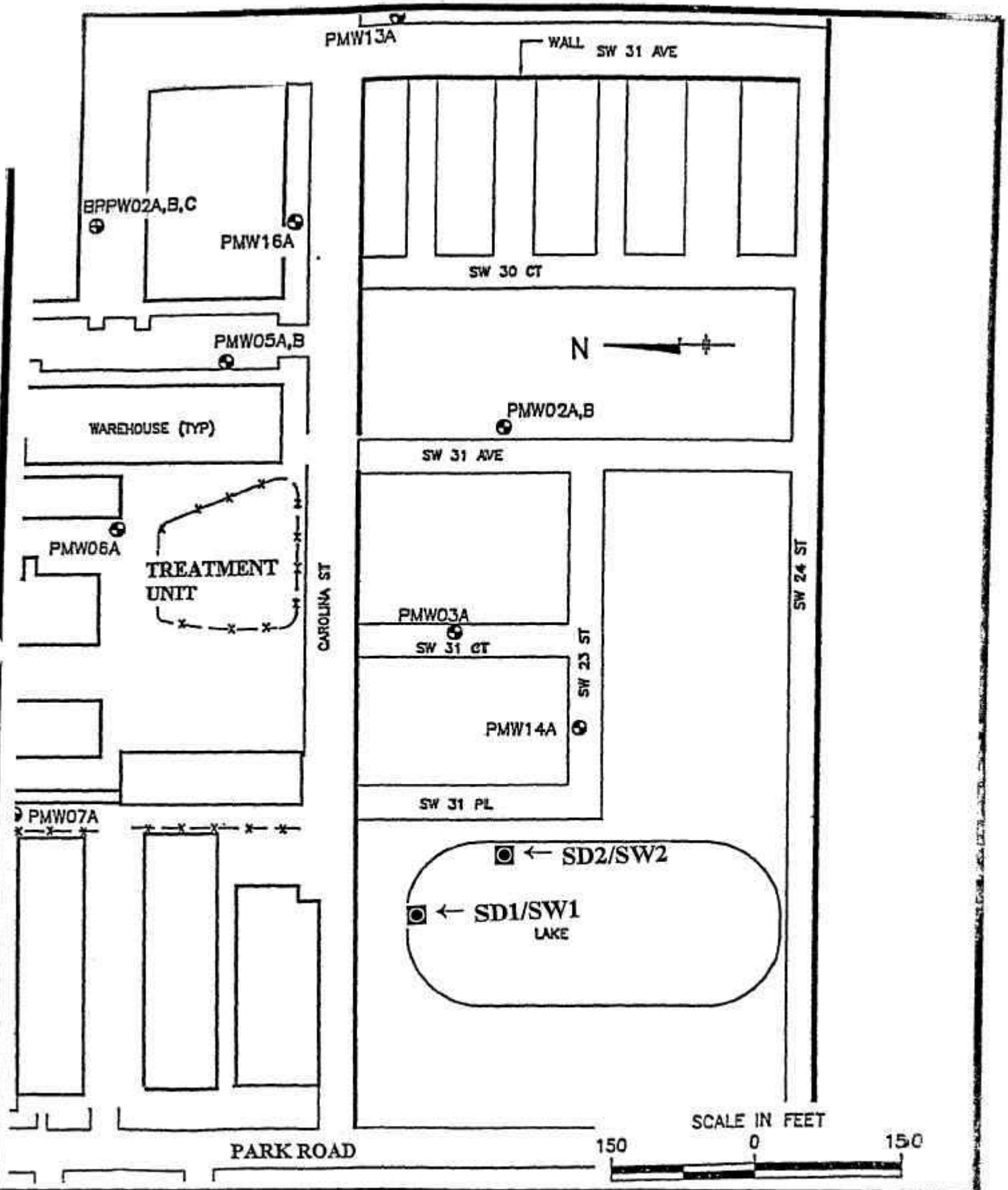
9



SOIL BORING LOCATIONS
PETROLEUM PRODUCTS
BROWARD COUNTY, FLORIDA

FIGURE NO.

10



LOCATION OF TRAILER
PARK LAKE SAMPLES

PETROLEUM PRODUCTS SITE
PEMBROKE PARK, FLORIDA

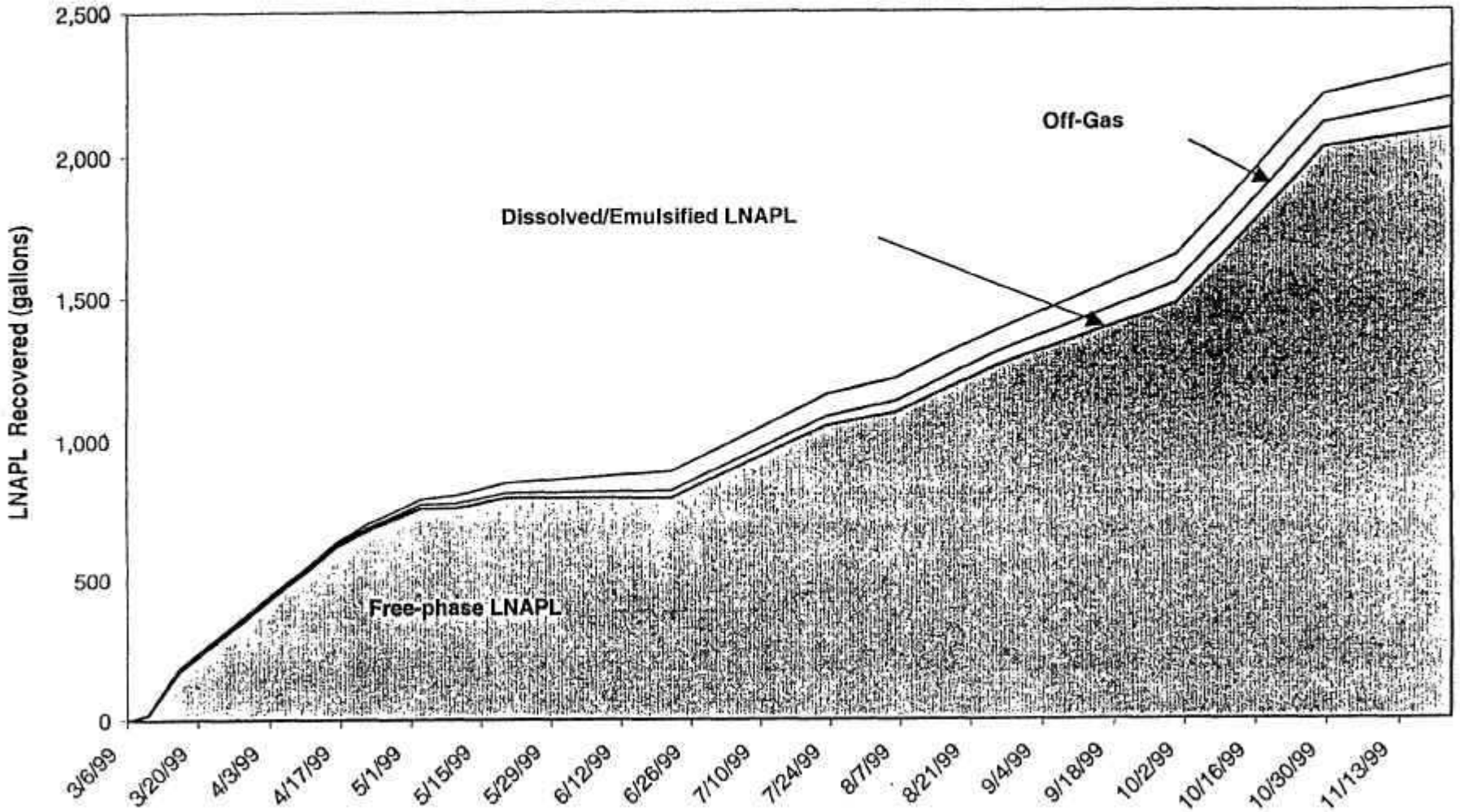
FIGURE NO.

11

DATE: 3-7-2003

FIGURE 12

Cumulative Volume of LNAPL Recovered During Full-Scale Bioslurper Operation (through November 23, 1999)



Tables

Tables

Table 1- Chronology of Site Events

Event	Date
PPC processes used oil by re-refining, sells product either as fuel or lubricating oil	1958 to 1970
PPC stops re-refining of used oil but continues to sell used oil as fuel oil	1970 to 1984
1,800 cubic yards of sludge removed and hauled to landfill. Pits are filled in and warehouses built	1970
PPC cleans up portion of Site in response to two warning notices	1979
FDER intiates lawsuit against PPC	June 1984
EPA issues an Adminstrative Order to PPC. PPC agrees to work under a consent order	March 1985
30 inch diameter recovery well is installed for free product recovery	1985
Site placed on NPL list with score of 40.11	July 1987
Remedial Investigation and Feasibility Study are submitted	March 1988
PPC determined eligible to participate in FDER's petroleum cleanup program	July 1990
Interim ROD is signed	October 1990
1992 Supplemental Remedial Investigation and Supplemental Feasibility Study are submitted	1992
Construction of Initial Waste Oil recovery System Completed in Operation	1995
Waste oil Recovery System is turned off and Construction of Bioslurper System Initiated	December 1998
Bioslurper System Begins Operation	March 1999
Bioslurper System shut down because of Free Product discovered in Injection Well	November 1999
Design of modified treatment system is approved	April 2000

Table 2 – Extraction Well Manifold System

Table Extraction Well Rotation Schedule

Manifold Set	Extraction Manifold	Extraction Wells Located on Manifold
1	A	EW-1, -2, -3, -5, -18; RW11-OW1, -OW2, -OW3
	F	EW-9, -10, -14; FDEP-OW2
2	B	EW-34, -35, -41; PZ-42
	D	EW-20, -32, -33, -46
	E	EW-7, -8, -15; FDEP-OW1
3	C	EW-22, -31; RW1-OW2, -OW3
	G	EW-17, -25; RW1-OW1
	H	EW-44, -45

TABLE 3 – Monitoring Well Sampling Schedule

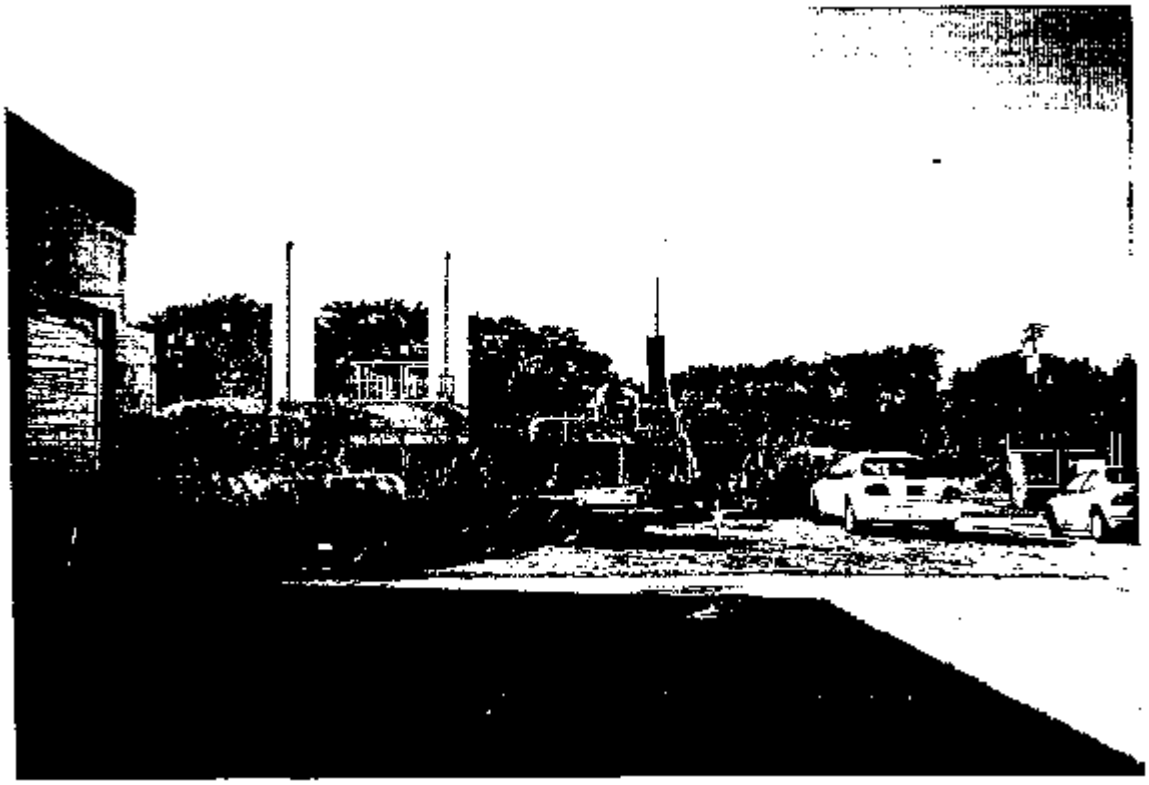
MONITORING WELLS TO BE SAMPLED
ON A QUARTERLY BASIS

SHALLOW WELLS	INTERMEDIATE WELLS	DEEP WELLS
BBLPMW5A	PMW12B	BPPW02C
PMW16A	PMW05B	DMW-B
BPPWO2A	PMW02B	
PMW21A	IMW-I	
PMWO5A	BPPW02B	
BBLPMW7A	BPPMW03B	
MW-B	IMW-B	
MW-D	PMW19B	
MW-G		
MW-A		

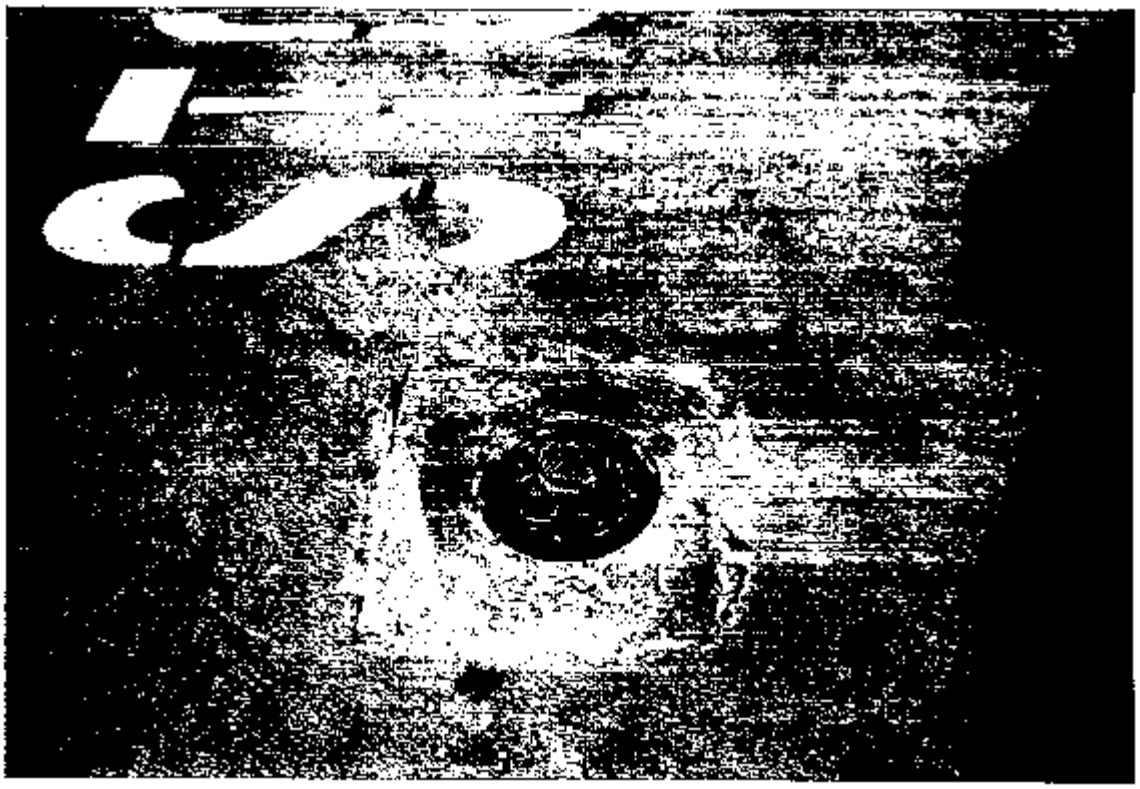
HOT SPOT
RW-3
RW-10
RW-7
PMW10A (Replace with RW-2 when product is eliminated)
MW-E (Replace with RW-4 when product is eliminated)
MW-C (Replace with RW-6 when product is eliminated)

Photographs

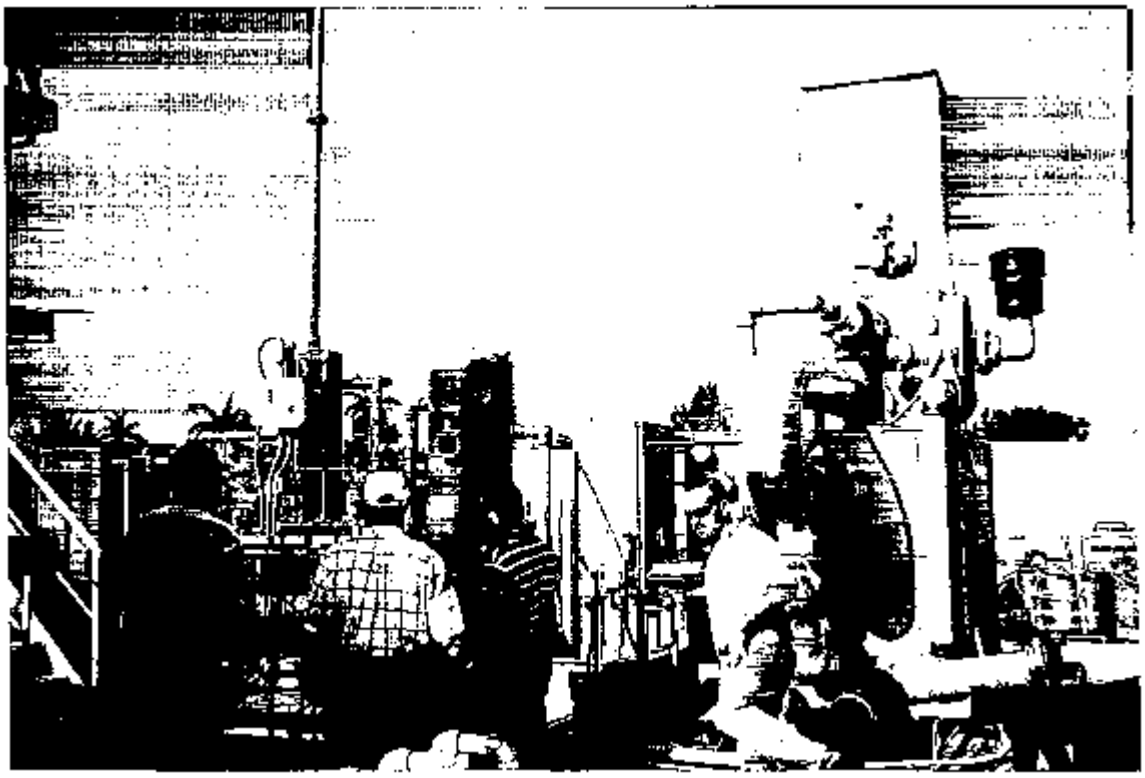
Photograph #1 **March 21, 2000**
Location: Petroleum Products Superfund Site, Broward County, Pembroke Park, Florida.
Description: Pit dug out in Warehouse Bay No. 261



Photograph #2 **March 21, 2000**
Location: Petroleum Products Superfund Site, Broward County, Pembroke Park, Florida
Description: View of treatment compound including two air stripping towers and privacy fence looking south.

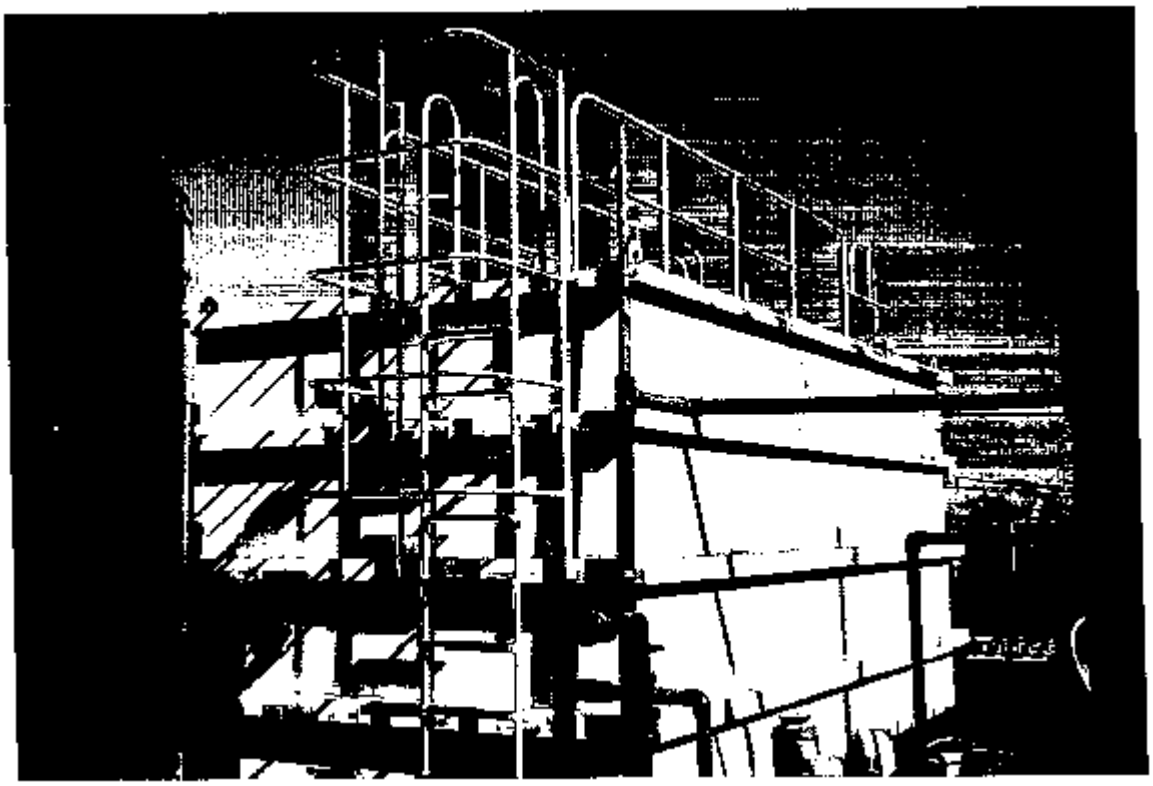


Photograph #3 **March 21, 2000**
Location: Petroleum Products Superfund Site, Broward County, Pembroke Park, Florida.
Description: Soil gas monitor at southeast portion of site (Well is bolted and secured).



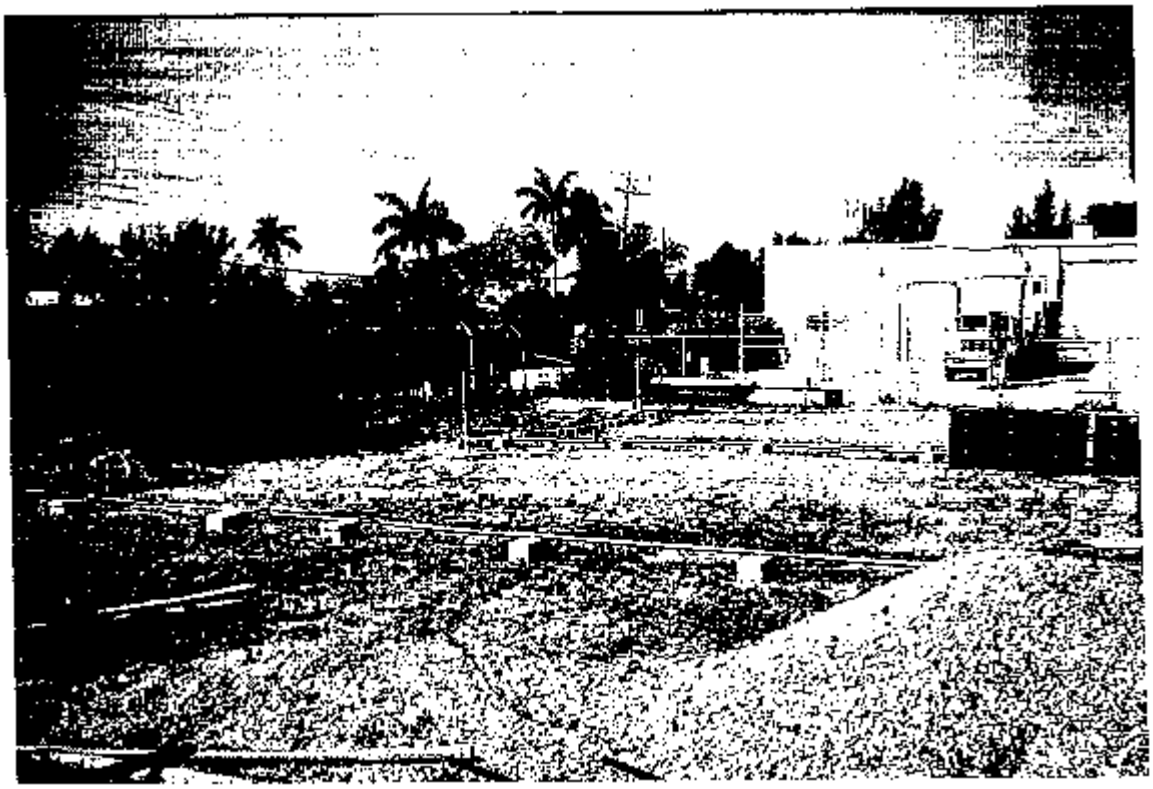
Photograph #4 **March 21, 2000**
Location: Petroleum Products Superfund Site, Broward County, Pembroke Park, Florida
Description: View looking toward west at oil/water separator and catalytic oxidizer.

Photograph #5 **March 21, 2000**
Location: Petroleum Products Superfund Site, Broward County, Pembroke Park, Florida.
Description: Oil water separator

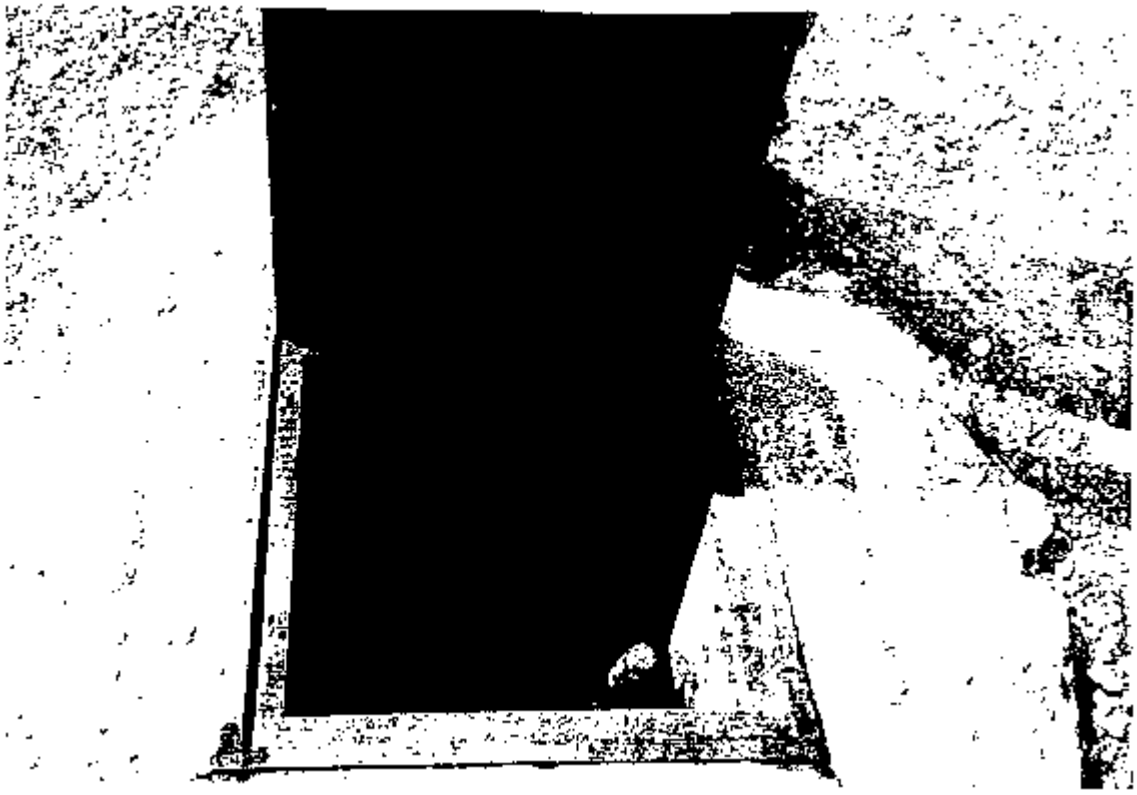


Photograph #6 **March 21, 2000**
Location: Petroleum Products Superfund Site, Broward County, Pembroke Park, Florida
Description: 18,000 gallon settling tank

Photograph #7 **March 21, 2000**
Location: Petroleum Products Superfund Site, Broward County, Pembroke Park, Florida.
Description: Bioslurping Well #17 looking northeast



Photograph #8 **March 21, 2000**
Location: Petroleum Products Superfund Site, Broward County, Pembroke Park, Florida
Description: Bioslurping well network looking west



Photograph #9 **March 21, 2000**
Location: Petroleum Products Superfund Site, Broward County, Pembroke Park, Florida.
Description: Off-line extraction well #33

Photograph #10 **March 21, 2000**
Location: Petroleum Products Superfund Site, Broward County, Pembroke Park, Florida
Description: Infiltration gallery looking toward gallery.

Photograph #11 **March 21, 2000**
Location: Petroleum Products Superfund Site, Broward County, Pembroke Park, Florida.
Description: Warning sign posted at entrance gate

Attachments

Attachment A

Documents Reviewed

Reports and Memorandums

(E&E, 1984) Environmental Science & Engineering, Inc., Preliminary Assessment of Free Oil Contamination at the Petroleum Products Site, December 1984.

Florida Department of Environmental Regulation, Hazard Ranking System Score Sheet, December 1984.

Dames & Moore, Site Assessment and Tank Inspection Response to Administrative Order, March 1985.

Dames & Moore, Report Status of Site Cleanup Activities, June 1985

(E&E, 1988a) Ecology and Environment, Inc., Remedial Investigation of Petroleum Products Corporation Site, March 1998.

(E&E, 1988b) Ecology and Environment, Inc. Feasibility Study Petroleum Products Corporation Site, March 1998.

Agency for Toxic Substances and Disease Registry, Health Assessment for Petroleum Products Company Site, April 1989.

(EPA, 1990) Interim Action Record of Decision, October 5, 1990.

(EPA, 1991) Explanation of Significant Differences, March 1991.

Ecology and Environment, Inc. Report of the Soil Washing Treatability Study, May 1991.

(Bechtel, 1992a) Bechtel Environmental, Inc. Supplemental Remedial Investigation Report for the Petroleum Products Corporation Site, January 1992.

(Clement, 1992) Clement International Corporation Baseline Risk Assessment for the Petroleum Products Corporation Superfund Site, June 1992.

(Bechtel, 1992b) Bechtel Environmental, Inc. Supplemental Feasibility Study Report for the Petroleum Products Corporation Site, July 1992.

Blasland, Bouck & Lee, Final Remedial Design Report for Petroleum Products Corporation Superfund Site, February 1993.

Blasland, Bouck & Lee, Remedial Action Work Plan, July 1993.

Blasland, Bouck & Lee, Operation and Maintenance Plan, October 1994.

Blasland, Bouck & Lee, Remedial Action Report Operable Unit 1, August 1995.

Science Applications International Corporation, Technical Assessment of In Situ Stabilization/Solidification Remedial Technologies for Potential Application to Soils and Sludges at the Petroleum Products Corporation Site, October 1995.

U.S. Geological Survey, Simulation of Groundwater Flow and Assessment of Transport of Contaminants at the Petroleum Products Corporation Site, 1996.

U.S. Geological Survey, Evaluation of a Free-Product and Groundwater Recovery System at the Petroleum Products Corporation Site, 1996.

National Remedy Review Board, Proposed Remedy for OU2, May 1996.

Battelle, Draft Work Plan for Bioslurping Pilot Scale Test at Petroleum Products Corporation Superfund Site, July 1997.

Battelle, Pilot Scale Bioslurper Report for Petroleum Products Corporation Superfund Site, September 1997.

Battelle, Work Plan for the Collection of Data for Bioslurper Design, February 1998.

Battelle, Technical Proposal for Construction and Startup of Bioslurper June 1998.

Battelle, Final Remedial Action Plan for Implementation of Full Scale Bioslurper System, October 1998.

Battelle, Design Changes to the Water Treatment Process for the Full-Scale Bioslurper System, March 1999.

Battelle, Draft Operations, Monitoring and Maintenance Manual for Operating the Bioslurper System at Petroleum Products Corporation, May 1999.

EPA, Perimeter Groundwater Monitoring Program, June 1999.

Battelle, As-Built Drawings for the Operations, Monitoring, and Maintenance Manual for a Full-Scale Bioslurper System at Petroleum Products Corporation Superfund Site, January 2000.

Periodical Reports

Battelle, Monthly Performance Status Report; Period Covered: May 1999 through December 1999.

CDM Federal Programs, Quarterly Groundwater Reports; November 1999; March 2000; April 2000.

De maximis, Inc. Monthly Reports; Period Covered: December 1998 through March 2000.

Attachment B

Site Inspection Checklist

Please note that "O&M" is referred to throughout this document. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as"system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the five-year review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION

Site name: Petroleum Products Corp.	Date of inspection: 3/21/00
Location and Region: Pembroke Park, FL	EPA ID: FLD980798698
Agency, office or company leading the five-year review: USACE, Jacksonville Distr.	Weather/temperature: Warm and sunny

Remedy Includes (Check all that apply)
- ☐ Landfill cover/containment
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other See Section IV.B of report

☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. O&M site manager Mike Miller (Name) PRP Consultant (Title) 3/21/00 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☒ Report attached See Section V.B of report.

2. O&M staff _____ (Name) _____ (Title) _____ (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

3. Local regulatory authorities and response agencies (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency FDEP
Contact Judy Kern ES-3 5/18/00 850-488-0190
Name Title Date Phone no.
Problems; suggestions; ☒ Report attached See Section V.B of report.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. Other interviews (optional) ☒ Report attached.

See Section V.B of report.

III. ONSITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Manual and As-Builts** ☒ Readily available ☒ Up to date ☐ N/A
   ☐ As-builts ☐ Readily available ☐ Up to date ☐ N/A
   ☐ Maintenance Logs ☐ Readily available ☐ Up to date ☐ N/A
   Remarks_____

2. **Site Specific Health and Safety Plan** ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☐ N/A
   Remarks_____

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks_____

4. **Permits and Service Agreements**
   ☒ Air discharge permit ☐ Readily available ☐ Up to date ☐ N/A
   ☒ Effluent discharge (UIC) ☐ Readily available ☐ Up to date ☐ N/A
   ☐ Waste disposal, POTW ☐ Readily available ☐ Up to date ☐ N/A
   ☐ Other permits_____ ☐ Readily available ☐ Up to date ☐ N/A
   Remarks Variance to air discharge permit granted by FDEP. Variance to Effluent Discharge permit granted by FDEP.

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks_____

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks_____

7. **Groundwater Monitoring Records** ☒ Readily available ☐ Up to date ☐ N/A
   Remarks_____

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks_____

9. **Discharge Compliance Records**
   ☒ Air ☒ Readily available ☐ Up to date ☐ N/A
   ☒ Water (effluent) ☒ Readily available ☐ Up to date ☐ N/A
   Remarks_____

10. **Daily Access/Security Logs**
☒ Readily available ☐ Up to date ☐ N/A
Remarks _____

IV. O&M COSTS

1. **O&M Organization**
☐ State in-house ☐ Contractor for State
☒ PRP in-house ☒ Contractor for PRP
☐ Other _____

2. **O&M Cost Records** See Section IV.D of report.
☒ Readily available ☒ Up to date
☒ Funding mechanism/agreement in place
Original O&M cost estimate _____ ☐ Breakdown attached

Total annual cost by year for review period if available

From _____ To _____ _____ ☐ Breakdown attached
Dates Total cost
From _____ To _____ _____ ☐ Breakdown attached
Dates Total cost
From _____ To _____ _____ ☐ Breakdown attached
Dates Total cost
From _____ To _____ _____ ☐ Breakdown attached
Dates Total cost
From _____ To _____ _____ ☐ Breakdown attached
Dates Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: _____

V. GENERAL SITE CONDITIONS

Whenever possible, actual site conditions should be documented with photographs.

A. Fencing

1.	Fencing damaged ☒ Location shown on site map ☒ Gates secured ☐ N/A Remarks good condition
B.	**Site Access**
1.	Access restrictions, signs, other security measures ☒ Location shown on map ☐ N/A Remarks See Photograph #11 of report
C.	**Perimeter Roads**
1.	Roads damaged ☐ Location shown on site map ☐ Roads adequate ☒ N/A Remarks
D.	**General**
1.	Vandalism/trespassing ☐ Location shown on site map ☒ No vandalism evident Remarks
2.	Land use changes onsite ☒ N/A Remarks
3.	Land use changes offsite ☒ N/A Remarks
4.	Institutional controls (site conditions imply institutional controls not being enforced) ☒ N/A Agency _____ Contact _____ _____ _____ _____ Name Title Date Phone no. Problems; suggestions; ☐ Report attached _____
	VI. LANDFILL COVERS ☐ Applicable ☒ Not applicable
A.	**Landfill Surface**
1.	**Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident Areal extent _____ Depth _____ Remarks

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
Lengths_____ Widths_____ Depths_____
Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
Areal extent_____ Depth_____
Remarks_____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
Areal extent_____ Depth_____
Remarks_____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
☐ Trees/Shrubs (indicate size and locations on a diagram)
Remarks_____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
Remarks_____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
Areal extent_____ Height_____
Remarks_____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent_____
Remarks_____

B. **Benches** ☐ Applicable ☒ Not applicable
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
   Remarks_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
   Remarks_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
   Remarks_____

C. Letdown Channels ☐ Applicable ☒ Not applicable
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
   Areal extent_____ Depth_____
   Remarks_____

2. **Material Degradation** ☐ Location shown on site map
   ☐ No evidence of degradation
   Material type_____ Areal extent_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
   Areal extent_____ Depth_____
   Remarks_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
   Areal extent_____ Depth_____
   Remarks_____

5. **Obstructions** Type_____ ☐ No obstructions
   ☐ Location shown on site map Areal extent_____
   Size_____
   Remarks_____

6.	**Excessive Vegetative Growth** Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks_____
D.	**Cover Penetrations** ☐ Applicable ☒ Not applicable
1.	**Gas Vents** ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Needs O&M ☐ Evidence of leakage at penetration ☐ N/A Remarks_____
2.	**Gas Monitoring Probes** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Needs O&M ☐ Evidence of leakage at penetration ☐ N/A Remarks_____
3.	**Monitoring Wells** (within surface area of landfill) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Needs O&M ☐ Evidence of leakage at penetration ☐ N/A Remarks_____
4.	**Leachate Extraction Wells** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Needs O&M ☐ Evidence of leakage at penetration ☐ N/A Remarks_____
5.	**Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A Remarks_____
E.	**Gas Collection and Treatment**
1.	**Gas Treatment Facilities** ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs O&M Remarks_____

2.	**Gas Collection Wells, Manifolds and Piping** ☐ Good condition ☐ Needs O&M Remarks_____
F.	**Cover Drainage Layer** ☐ Applicable ☒ Not applicable
1.	**Outlet Pipes Inspected** ☐ Functioning ☐ N/A Remarks_____
2.	**Outlet Rock Inspected** ☐ Functioning ☐ N/A Remarks_____
G.	**Detention/Sedimentation Ponds** ☐ Applicable ☒ Not applicable
1.	**Siltation** Areal extent_____ Depth_____ ☐ N/A ☐ Siltation not evident Remarks_____
2.	**Erosion** Areal extent_____ Depth_____ ☐ Erosion not evident Remarks_____
3.	**Outlet Works** ☐ Functioning ☐ N/A Remarks_____
4.	**Dam** ☐ Functioning ☐ N/A Remarks_____
H.	**Retaining Walls** ☐ Applicable ☒ Not applicable
1.	**Deformations** ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks_____
2.	**Degradation** ☐ Location shown on site map ☐ Degradation not evident Remarks_____

I.	**Perimeter Ditches/Off-Site Discharge** ☐ Applicable ☒ Not applicable
1.	**Siltation** ☐ Location shown on site map ☐ Siltation not evident Areal extent_____ Depth_____ Remarks_____
2.	**Vegetative Growth** ☐ Location shown on site map ☐ N/A ☐ Vegetation does not impede flow Areal extent_____ Type_____ Remarks_____
3.	**Erosion** ☐ Location shown on site map ☐ Erosion not evident Areal extent_____ Depth_____ Remarks_____
4.	**Discharge Structure** ☐ Functioning ☐ N/A Remarks_____
	VII. VERTICAL BARRIER WALLS ☐ **Applicable** ☒ **Not applicable**
1.	**Settlement** ☐ Location shown on site map ☐ Settlement not evident Areal extent_____ Depth_____ Remarks_____
2.	**Performance Monitoring** Type of monitoring_____ ☐ Performance not monitored Frequency_____ ☐ Evidence of breaching Remarks_____
	VIII. GROUNDWATER/SURFACE WATER REMEDIES ☒ **Applicable** ☐ **Not applicable**
A.	**Groundwater Extraction Wells, Pumps, and Pipelines** ☒ Applicable ☐ Not applicable

1. **Pumps, Wellhead Plumbing, and Electrical**
☒ Good condition ☐ All required wells located ☐ Needs O&M ☐ N/A
Remarks See Section V.C of report.

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☒ Good condition ☐ Needs O&M
Remarks See Section V.C of report

B. Surface Water Collection Structures, Pumps, and Pipelines
☐ Applicable ☒ Not applicable

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs O&M
Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs O&M
Remarks

C. Treatment System ☒ Applicable ☐ Not applicable

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☒ Oil/water separation ☐ Bioremediation
☒ Air stripping ☒ Carbon adsorbers
☒ Filters air ☒ Others thermal treatment (gases) avail. for use.
☒ Good condition ☐ Needs O&M
☒ Sampling ports properly marked and functional
☒ Sampling/maintenance log displayed and up to date
☒ Equipment properly identified
☒ Quantity of groundwater treated annually In 1999, 2.5 million gallons (9 mo period)
☐ Quantity of surface water treated annually
Remarks See Section VI of report for further discussion

2. **Electrical Enclosures and Panels** (properly rated and functional) ☐ N/A
☒ Good condition ☐ Needs O&M
Remarks

3. **Tanks, Vaults, Storage Vessels** ☐ N/A
☒ Good condition ☐ Proper secondary containment ☐ Needs O&M
Remarks

4. **Discharge Structure and Appurtenances** ☒ N/A
☐ Good condition ☐ Needs O&M
Remarks _____

5. **Treatment Building(s)** ☒ N/A
☐ Good condition ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks _____

6. **Monitoring Wells** (pump and treatment remedy) ☐ Properly secured/locked
☒ Functioning ☒ Routinely sampled ☒ Good condition ☐ All required wells located
☐ Needs O&M ☐ N/A
Remarks Some wells were observed to have no locks.

D. Monitored Natural Attenuation N/A

1. **Monitoring Wells** (natural attenuation remedy) ☐ Properly secured/locked
☐ Functioning ☐ Routinely sampled
☐ Good condition ☐ All required wells located ☐ Needs O&M ☐ N/A
Remarks _____

IX. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

X. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

See Sections IV.B, VI, VII, and VIII of report

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

See Section IV.D, VI, VII, and VIII of report.

C.	**Early Indicators of Potential Remedy Failure**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. See Section VI, VII, VIII, and IX of report.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. See Section VIII and IX of report.